Official Organ of the American Welding Society

The Welding Engineer

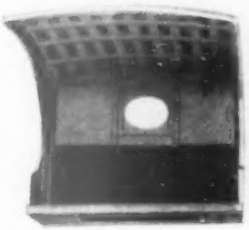
Edited by L. B. Mackenzie

$3.00 per year in U. S. | Reg. U. S. Pat. Office | $4.00 per year abroad

Vol. 5 | Chicago 608 S. Dearborn St. | MAY, 1920 | New York 171 Madison Ave. | No. 5

The Right Kind of a Weld Helps Sell the Product

Talk to the average dealer about trucks and the chances are ten to one he'll ask you how you make your bodies.



Talk to leading auto manufacturers and they'll tell you they weld their bodies with TORCHWELD APPARATUS.

Any make of oxy-acetylene welding apparatus may seem O. K. to you until you've tried a TORCHWELD. When you start using TORCHWELD TORCHES you'll see how it's possible for TORCHWELD USERS to make such perfect body welds.

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O-519

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9220

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.

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See "Torches"

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See "Torches"

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Cast aluminum can be welded without flux by using the puddling spoon, but welding of some aluminum castings is impracticable without flux. DeeBee aluminum powder is recommended for welding broken motor crank cases and other thin cast aluminum. It speeds up welding and makes smooth work easy.

Napolitan flux developed in the Davis-Bournonville laboratory as a result of many experiments is widely used in welding aluminum kitchenware and other aluminum products. Its action is marvelous; all resistant film is broken down and the molten metal flows like water. Atlas scaling powder eliminates scale, oxide and foreign matter from molten cast iron and facilitates clean welding. If you use D-B cast iron welding sticks and Atlas scaling powder you will have no hard spots in the welds to spoil cutting tools when machined.

Davis-Bournonville torches, welding rods and welding fluxes, in the hands of competent men, sweep away welding troubles and bring joy to the welding shop. Try them and be convinced. On sale at branches in principal cities.

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Hauck Mfg. Co.
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International Oxygen Co.
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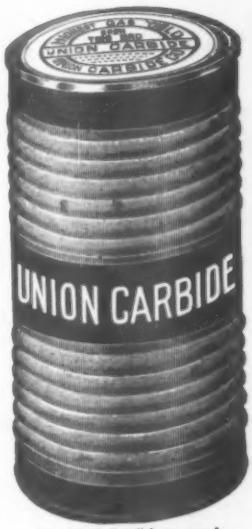

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Denver—Nineteenth and Wazee Sts.
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Springfield—217 S. 4th St.
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LOUISIANA
New Orleans—619-21 Julia St.
MAINE
Portland—11 Exchange St.
MARYLAND
Baltimore—19 E. Lombard St.
Cumberland—1 N. Liberty St.
Salisbury—Opp. Fulton Station.
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Boston—(See Cambridge "A.")
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Springfield—Napier St.
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Detroit—Grand River and Lorain Ave.
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Jackson—172 South Water St.
Muskegon—303 W. Western Ave.
Saginaw—1830 No. Michigan Ave.
Sault Ste. Marie.
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Kansas City—1316-1318 W. Eighth St.
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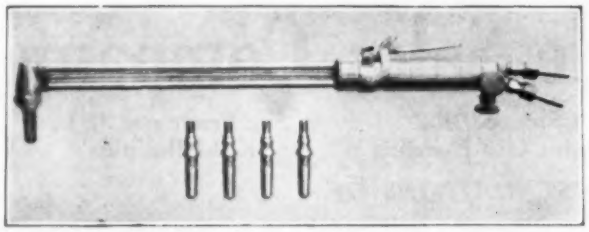

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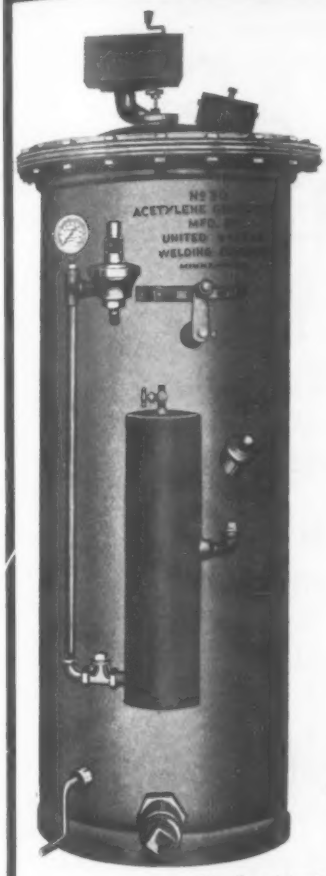

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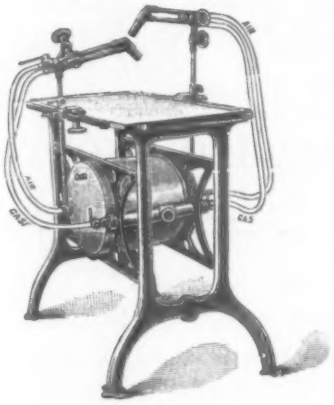

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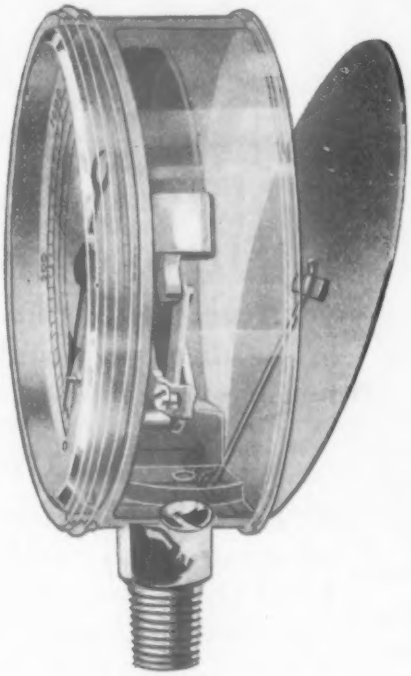

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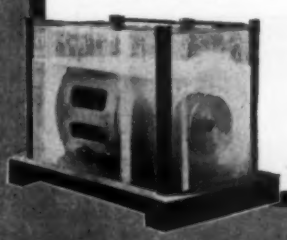

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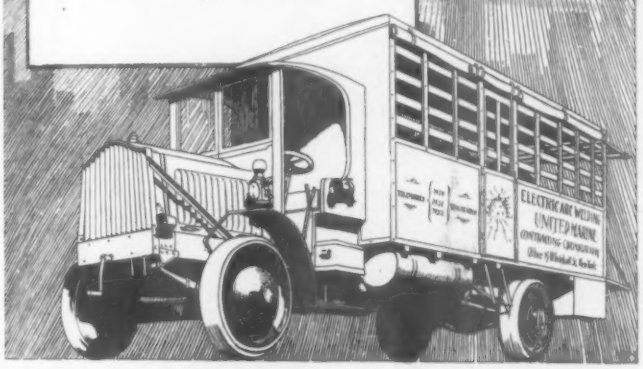

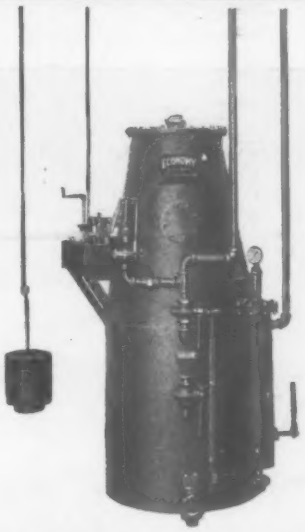

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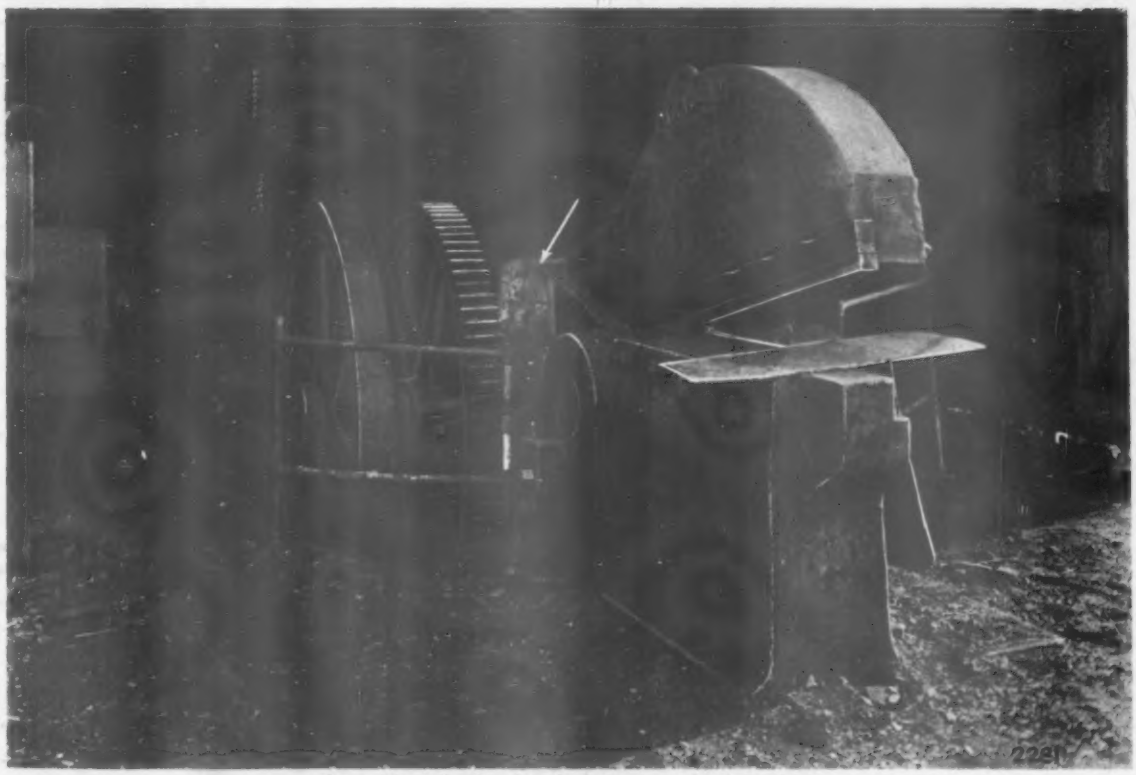

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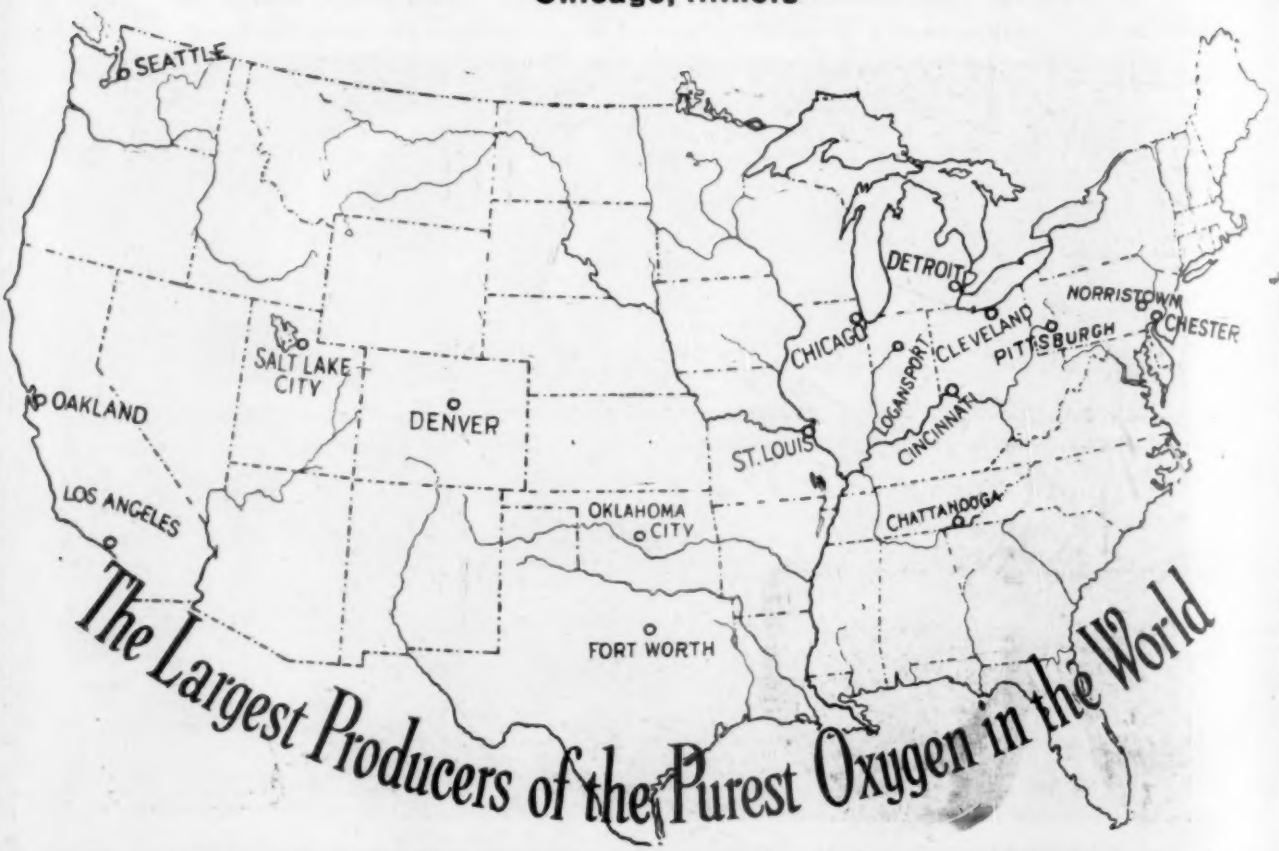

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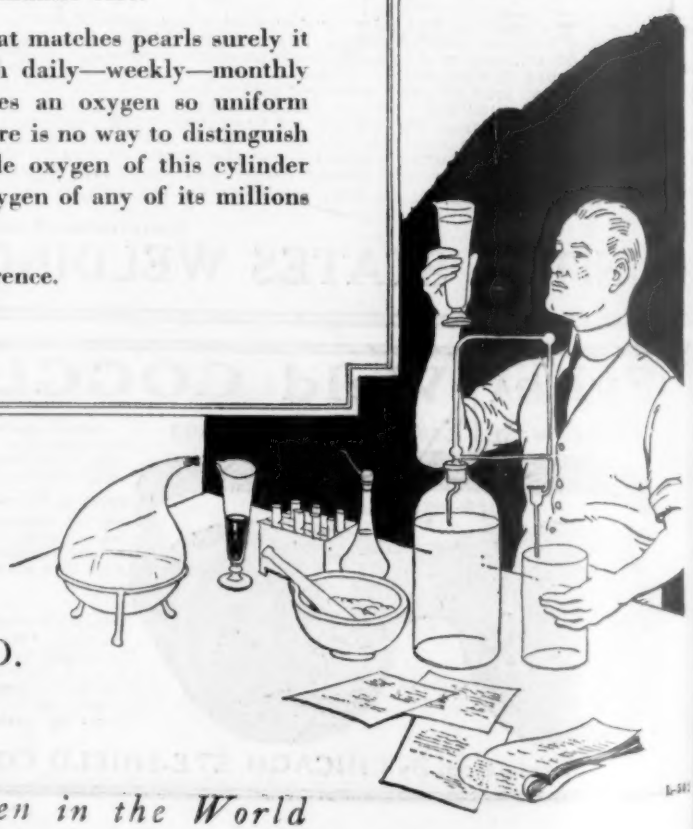

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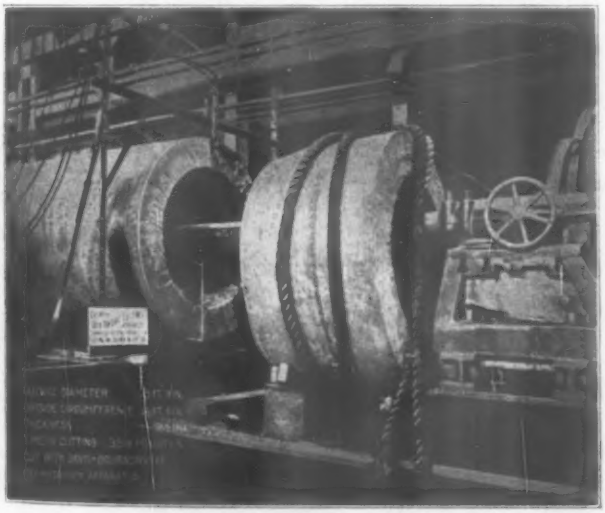
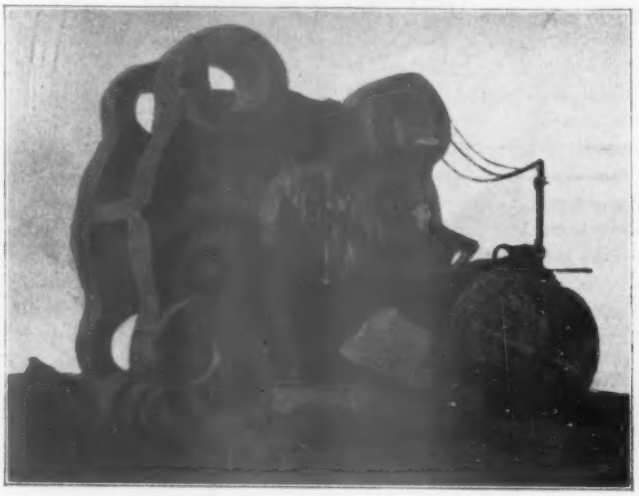
GAS CUTTING

By Fred E. Rogers

GAS cutting is a process of burning iron apart. An iron or steel wire supported in a jar of oxygen will burn. It burns fiercely with a shower of sparks and is quickly consumed. But the wire in the oxygen atmosphere will not begin to burn until some part is raised to the igniting temperature. The same law holds that applies to ordinary combustion. The fire must be started and then it will continue burning. The heat produced maintains the igniting temperature and combustion proceeds until all the steel within the oxygen atmosphere is consumed. In order to "gas cut" iron, therefore, it is only necessary to produce the conditions under which it will burn. These conditions are, heating to the temperature at which it will ignite and then supplying the oxygen which supports combustion.



Riser Cut with Torch from Jacket Steel Casting While Turning in Lathe.



36-inch Riser Cut from Steel Press Casting with the Radiograph.

The Cutting Torch

The apparatus with which this is accomplished is the cutting torch.

The modern gas cutting torch is similar in appearance to the welding torch, but differs in the construction and method of control. It has three metal gas tubes, two for oxygen and a third for the acetylene, hydrogen or other combustible gas. The gases required for the preheating flame mix in the head the same as in the welding torch. The torch is applied for cutting by adjusting the needle valves to produce a slightly oxidizing flame. The preheating flame applied to the edge of a steel plate quickly raises it to the white hot temperature when the auxiliary oxygen valve is opened, thus admitting a streamer or jet of pure oxygen along with the preheating flame. Instantly the white hot metal takes fire and burns with a shower of sparks. The burning oxidized metal rolls down the sides of the kerf, supplying the heat to ignite the metal in its path and falls on the floor below.

The atmosphere of oxygen required for cutting metals is thus produced by directing a jet of compressed oxygen from the torch tip along the cut. The preheating jets raise the metal to the burning point and maintain it there over and above the radiation loss. The zone of combustion is confined approximately to the width of the oxygen jet, which can be made 1/16-inch or even less, and the direction of cutting therefore is in perfect control.

Supplies and Apparatus Required for Cutting

The supplies required for gas cutting consist of oxygen which is generally furnished in steel cylinders compressed to 1,800 to 2,000 pounds per square inch, and of acetylene also supplied in cylinders at a pressure of about 225 pounds per square inch or of hydrogen gas compressed in steel cylinders to pressures of 1,800 to 2,000 lbs. Pressure reducers or regulators are required in the torch. Each pressure regulator requires two pressure gauges, one indicating the pressure in the cylinder and the other the working pressure to

which the regulator is adjusted. Two hoses connect the cylinders with the cutting torch. All these gases may be produced with apparatus that can be installed in a manufacturing plant and operated at low cost. In such cases pipe lines are generally laid to convey the gases to the points of use, or they may be compressed into containers under moderate pressures and transported to the work.

Oxygen and acetylene are used preferably for all cutting up to 14 to 16 inches thicknesses, but on very thick cutting (like heavy armor plate) it has been demonstrated that hydrogen displaces acetylene to advantage. Acetylene is superior on the thinner sections because of the greater heat of the preheating flame which enables the operator to start the cut quickly. But it does not produce so long a flame as hydrogen and does not maintain a very deep cut as efficiently as oxy-hydrogen, the long hydrogen flame more efficiently maintaining fluidity of the iron oxide at the bottom of the deep cut. So when cutting sections of from 16 to 24 inches thickness as in heavy armor plate cutting, it is customary to use oxy-hydrogen in preference to oxy-acetylene.

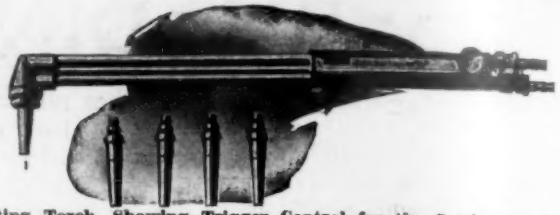
Details of Cutting

In cutting a hole out of a plate it is usual to start inside the line as the jet does not cut cleanly until after it has penetrated the plate. In cutting out a manhole, for instance, the shape and location should be accurately laid out. The

Model Anchor Cut from ½-inch Steel Plate with the Orygraph Using a Double Scale Drawing for Guide.

cut is started by penetrating inside the line a short distance and as soon as the flame has penetrated the cut is carried to the line which is then followed.

The rate of cutting varies with the thickness of the steel, the size of tip and oxygen pressure. The No. 1 tip requires an acetylene pressure of three pounds per square inch and an oxygen pressure of ten to twenty pounds depending on the thickness of the metal. This size tip is suited for cutting steel ⅛ to $\frac{3}{16}$ inch thick. The gas consumption in continuous cutting is about 12 cubic feet of acetylene and 55 cubic feet of oxygen per hour on $\frac{3}{16}$ inch steel. At the other end of the scale, but by no means at the limit of heavy cutting, is the No. 5 tip, suited for cutting 10 inch steel, and using 30 cubic feet of acetylene, and 1,000 cubic feet of oxygen hourly. The pressure of oxygen required for heavy cutting ranges



Cutting Torch, Showing Trigger Control for the Cutting Oxygen Jet.

from 100 to 150 pounds per square inch. High oxygen pressures are used for very heavy cutting.

Approximate Gas Consumption

Diameter Cutting Ports	Thickness of Metal Inches	Acetylene Pressure Lbs.	Oxygen Pressure Lbs.	Acetylene Consumption Per Hour	Oxygen Consumption Per Hour
.098″	⅛	3	10	12 cu. ft.	42 cu. ft.
	$\frac{3}{16}$	3	15	12 cu. ft	48 cu. ft.
	¼	3	20	12 cu. ft.	55 cu. ft.
	$\frac{5}{16}$	3	20	12 cu. ft.	55 cu. ft.
.0860″	¼	3	10	12 cu. ft.	62 cu. ft.
	½	3	20	12 cu. ft.	84 cu. ft.
	¾	3	30	12 cu. ft.	106 cu. ft.
	1	3	35	12 cu. ft.	116 cu. ft.
.0670″	1	4	30	19 cu. ft.	142 cu. ft.
	1½	4	40	19 cu. ft	172 cu. ft.
	2	4	50	19 cu. ft.	202 cu. ft.
	3	4	60	19 cu. ft.	232 cu. ft.
.0595″	3	5	60	30 cu. ft.	316 cu. ft.
	4	5	70	30 cu. ft.	356 cu. ft.
	5	5	85	30 cu. ft.	416 cu. ft.
	6	5	100	30 cu. ft.	476 cu. ft.
.0465″	6	6	90	30 cu. ft.	600 cu. ft.
	7	6	100	30 cu. ft.	668 cu. ft.
	8	6	125	30 cu. ft.	838 cu. ft.
	10	8	150	30 cu. ft.	1,008 cu. ft.

Operators frequently adjust the pressure regulators from one to two pounds above the figures given in the table to allow for gauge variations and drop of pressure when the gases are supplied in cylinders.

The force of the oxygen jet is an important factor in controlling the accuracy of cutting. With high pressure the thickness of cutting possible is truly amazing. Armor plate 24 inches thick and even thicker has been cut successfully.

Gas Cutting Machines

The hand cutting torch is a most efficient tool, in the hands of a competent operator. But it is not so efficient for heavy cutting as the machine-supported torch because the workmen's hands are unavoidably unsteady and the rate of progress or speed is not so strictly in accord with the combustion rate as is possible in the machine. Numerous hand operated cutting machines were patented by Jottrand shortly after his first invention but their value was comparatively slight. The principal requirement of the gas cutting machine is uniform traverse of the torch. Machines operated by hand, therefore, not meeting this requirement to the fullest extent are at a disadvantage with the mechanically traversed torches of modern cutting machines. The modern machines which mechanically support and feed the torch have greatly increased the scope of the gas cutting process, making its use possible in tool rooms for cutting dies or in shipyards for cutting ship plates and armor plates and in boiler shops for cutting boiler heads, manholes and in general for all purposes where rapid, cheap and accurate cutting of steel parts is required. The mechanical feed when properly adjusted insures that the rate of cutting should be no faster nor slower than the jet will efficiently produce. The hand-operated torch cannot be so efficiently controlled, as the

operator must be guided by the action of the torch itself and its actual progress almost always lags considerably behind the rate of cutting possible. If he exceeds in the cutting rate the action stops and time is lost in restarting the cut.

Metals Cut With the Torch

The metals that can be cut with facility with the gas cutting torch are wrought iron, and steels of comparatively low carbon content. High carbon steels are successfully cut with the oxygen jet if preheated to a temperature that depends somewhat on the carbon content and the various alloys contained. The higher the carbon content, the greater the degree of preheating required. A black heat will suffice for ordinary tool steel, whereas a low red may be required for some of the alloy tool steels. Brass and bronze plates have been cut by interposing them between steel sheets. The cut produced in the steel sheet persists through the brass or bronze plate and the lower steel sheet confines the kerf to approximately the same width as that in the steel sheet on top.

Uses for Gas Cutting

The uses to which hand-operated and machine-operated cutting torch can be put to in manufacturing, shipbuilding, car building, boiler making, fabricating and repair work are legion. In fabricating shops the cutting torch is invaluable; steel beams, angles, channels and other structural shapes may be cut and trimmed to any angle required with the torch at a fraction of the expense of cutting mechanically. The process is especially valuable in the field where ordinary cutting machines are not available. One large forge company produces marine engine crank cheeks from forgings at a small fraction of the cost of ordinary roughing machine cuts. The contour is cleanly and precisely cut through metal ten inches thick. One of the important uses of gas cutting is in the junk yard. Old steel boilers can be cut with the torch into junk and merchantable plat at small cost.

One of the numerous economies effected by the use of the cutting torch, used extensively during the war, was nicking and breaking bars and billets for shells. Such enormous quantities were required to be cut to shell length that it was impossible to get the machines and the operators required for machine cutting. The cutting torch was used for nicking billets with great success. It was found that a billet 5½ inches thick, for example, requires nicking with the torch flame to a depth only of ½ to ¾ inch. The cut made the breaking of the billet under a drop hammer, hydraulic press or on a bulldozer a comparatively easy and quick operation. The nicked bars were broken apart on a bulldozer running at the rate of about 20 to 30 strokes a minute.

The gas welder or arc welder should use the cutting torch as a tool for preparing work for welding. Of course, its use is practically limited to wrought iron and steel. But for beveling steel, cutting angles and preparing structural steel parts for assembling and welding, the cutting torch has no equal as an efficient tool. Steel plates that require trimming or shaping may be cut very quickly and smoothly with the torch. If manholes are required it is not necessary even to drill a hole as the jet will penetrate and when penetration has been accomplished the cutting may be directed at will. The speed of performance of gas cutting is high and the cost of cutting so low that no other method can compare with it in efficiency.

Defects in Cutting

1. Wide kerf. Strive to cut as narrow a path as possible in order to save steel and gas.

2. Ragged edges, caused by poor quality oxygen and unsteady holding of torch.

3. Underhanging and overhanging edges, caused by not directing the oxygen stream squarely downward but at an angle.

Cutting should be done at a pit built of brick or concrete, or with a metal plate standing vertically between the sparks and operator's legs. The sparks should be directed into a large metal can if no pit or other protection is available. Avoid directing the spark against anything that will take fire.

It is impossible in a short article to give more than a general idea of the many uses that can be made of the cutting torch, especially if mechanically guided.

Discussions of Ralph G. Hudson's Paper on a Theory of Metallic Arc Welding

O. H. Escholz:—The subject of Prof. Hudson's paper is of fundamental importance to those interested in the development of arc welding electrodes or processes. During the past few years there has been considerable speculation as to the nature of the mechanism of metal transport, particularly when welding overhead. I understand that Prof. Hudson attributes the force of the metallic blast mainly to the expansion of carbon monoxide gas formed by the union of atmospheric oxygen with the carbon present in the electrode material. If this is the case it would appear that greater difficulty should be encountered in overhead welding when using a low carbon content (0.05%) electrode than when employing a mild steel (0.2%) carbon rod. It is, however, well known that shipyards and locomotive builders employ both types of electrodes for overhead welding and their performance is quite comparable. However either type of electrode may be rendered useless for this purpose if subjcted to a suitable thermal treatment.

Observation of the deposition characteristics of a great variety of electrodes indicates that the production of the metallic blast is due in part to

(1) Liberation and expansion of occluded, absorbed or combined gases such as hydrogen, oxygen and nitrogen, etc.

(2) Expansion of gaseous or vaporous products as a result of the union of occluded gases with the electrode constituents.

(3) Sudden expansion of the electrode metal as a result of its rapid transition from the solid to liquid and vapor forms.

It is well known that all metals absorb gas, the quantity varying greatly with the characteristics, preparation and exposure of the metals. Iron has been found to contain under some conditions as much as 50 volumes of gas. It is, therefore, conceivable that the sudden release and expansion of such gas on liquefying the electrode arc terminal would create an appreciable pressure assisting in the production of a metallic blast. Similarly, it is conceivable that the rapid formation and subsequent expansion of carbon monoxide, carbon dioxide and oxide vapors as a result of the union of occluded oxygen with electrode constitutents may also add materially to the force of the blast.

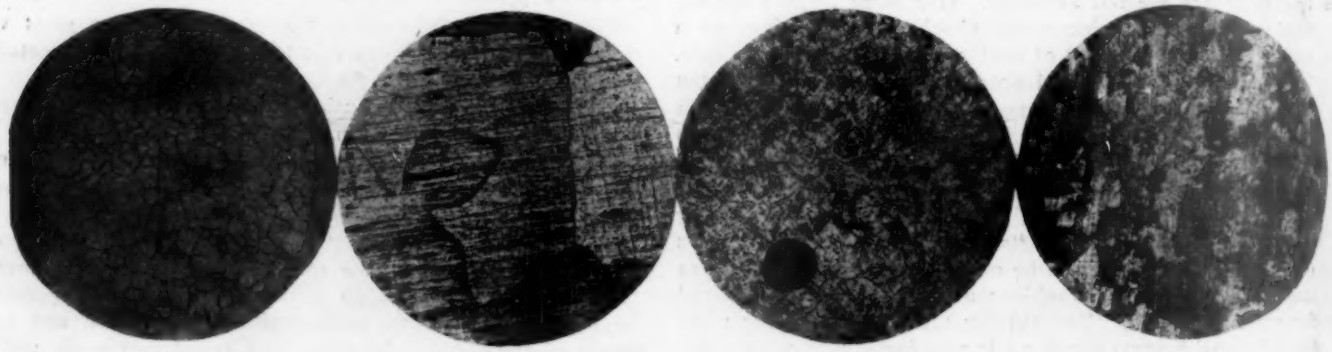
Professor Hudson discusses, on page 8, the globular electrode end shown in Fig. 1, attributing the formation of the sphere, I believe, to the expansion of carbon monoxide within the body of the metal. I have observed, however, that similar spheres or globules may be formed which are solid when employing electrodes ranging in carbon content from .02 per cent to 1.5 per cent. It appears that a more obvious explanation of such globular formation may be found in the familiar phenomenon of molecular attraction producing a tension on the liquid surface tending to hold it to a spherical form.

Upon cooling, the globular end of a high carbon content electrode presents a smooth surface, and a section thru its center shows the globule to be solid. The surface of a globule formed on the end of a low carbon content electrode is frequently deeply pitted giving a part of the globule end the appearance of a thin shell. This difference in the two types of globules is observable only after breaking the arc and appears to me to be due solely to a difference in the rate of oxidation of the incandescent metal, the high carbon content globule oxidizing slowly as a result of the presence at its surface

of a protecting atmosphere of carbon monoxide or dioxide caused by the initial oxidation of its surface. On interrupting the arc after forming a globule on the end of a low carbon content electrode, rapid burning or oxidation of the globule end is distinctly visible. It appears, therefore, to be unnecessary to assume that globular formation or the presence of a thin skin of metal is due to the internal expansion of carbon monoxide.

These globules may apaprently be formed with almost any arc length providing the end of the globule does not come in contact with the liquefied plate metal. If such contact is made, molecular attraction draws the hotter and therefore more mobile electrode globule to the plate. In overhead welding, when maintaining a short arc length, welders describe this phenomena by saying that the electrode metal "jumps" to the plate. As an extreme case I have observed metal deposited overhead with some bare electrodes without the formation of an arc, the conveyed metal remaining continuously in a plastic or liquid form, the potential across the electrodes varying from 6 to 10 volts.

After observing the performance of numerous types of electrodes on overhead welding it appears probable that most of the electrode metal is transported by molecular attraction, some by the condensation of vaporized metal and some by the movement imparted to the metal by gas or vapor expansion. The relative amounts transported by these means depend upon the electrode characteristics. The crater formed on overhead welding is probably due mainly to the pressure of the vapor and gas blast from the pensile electrode and partly to the erosion produced by oxidation and evolution of gas and vapor at the crater arc terminal. It is my conviction, however, that the evidence available at present is too incomplete to warrant more than a tentative theory of metal transport in overhead welding for all types of electrodes.



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W. E. Ruder:—In connection with this interesting paper by Mr. Hudson, I wish to call attention to certain observations of the conduct of the electrodes of various compositions and under different conditions, made at the Research Laboratory.

After welding sections of tips of the electrodes used were prepared and examined under the microscope. Three zones were observed, (1) the fused tip, (2) the recrystallized section extending from the fused tip back about ⅛ inch and (3) the unchanged cold worked (usually) electrode material. The gas bubbles are found only in the fused zone, the length of which increase with the length of the arc used and with the purity of the metal used, in spite of the fact that this material is of higher melting point than metal containing impurities. Specially prepared iron wire (Fig. 1) practically free from carbon, sulphur, phosphorus and oxygen could not be used in overhead welding because of the dripping of the iron, molten globules of which, ran down the sides of the electrode. With the electrode held over the work, too, very unsatisfactory results were also obtained. The metal would fuse rapidly and drop in large globules on the surface of the plate like so much molten solder, but it would not "bite" in. Electrodes containing appreciable amounts of carbon always gave square tips, appearing to blow off the metal in smaller drops than the so-called carbonless electrodes.

With covered wire very few holes are ever seen in the fused zone which is usually very short, and in many cases these blow-holes are entirely absent.

Explanation of the formation of these bubbles, in view of these observations, is explained as follows. Molten iron is a very good solvent for either carbon or oxygen, but each objects to the presence of the other. All steel refining depends upon this principle. In the open-hearth, ore is added to reduce the carbon content, resulting in a violent "boil" due to the evolution of CO. In the metallic arc when even a very small amount of carbon is present this condition is duplicated. The molten iron is rapidly oxidized and this oxide is as rapidly dissolved, due to the churning action of the molten tip. This causes the formation of CO which, due to sudden expansion, blows some of its surrounding material away.

That this reaction actually takes place can be seen from micrographic study of the tips. Pure iron tips have larger molten areas in which large amounts of oxide are dissolved (Fig. 2) and practically no gas bubbles. Electrodes with normal carbon content (.05 — .1%) give tips in which less dissolved oxygen is noted. Blow holes are usually present near the unfused boundary line, but the fused portion of these tips is very short on account of the explosive action of the CO blowing the metal off at a rapid rate. Constant feeding in of carbon into molten iron in which oxygen is dissolved, causes a rapid formation of CO which does not allow any very large drops of molten metal to form.

These observations are in entire agreement with Mr. Hudson's conclusion "that metal deposited during metallic arc welding is transmitted, in part at least, in the form of minute particles which are projected from the electrode globules by internal expansion of some vapor, possibly carbon monoxide." In fact, if I were to make this statement I would leave out the "possibly." The evolution of gases does play an important part in metal transfer.

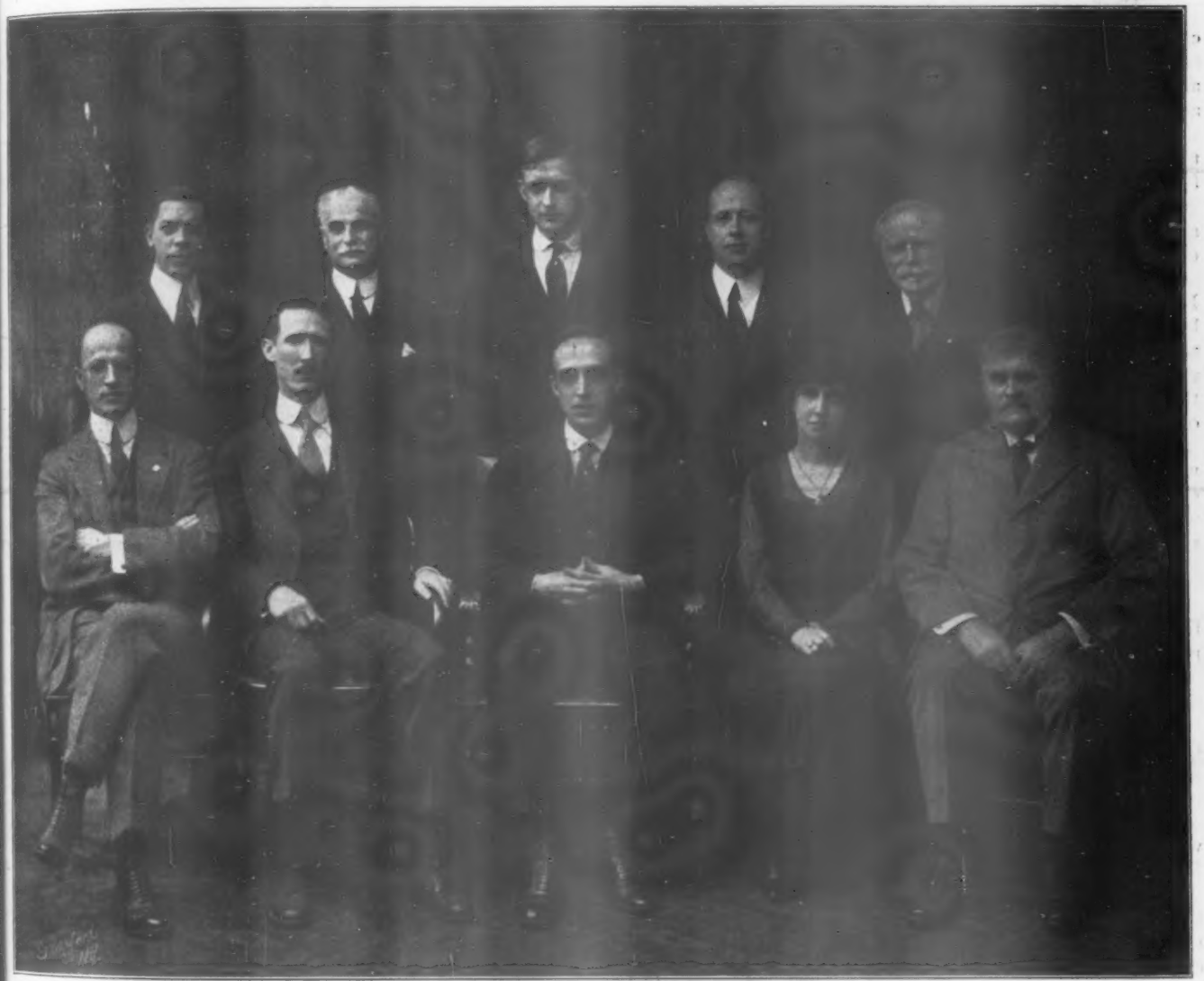
I do not believe, however, that there is any selective melting to explain the expulsion of the molten metal. Iron at the melting point rapidly dissolves carbon in all percentages likely to be found in the ordinary welding wire.

Sulphides and phosphides are also dissolved at this temperature and combine with the oxygen present, forming temporarily, at least, a gaseous product.

For this reason it does not seem likely that the difference in fusion and vaporization of the impurities can play any part in the transfer of the metal. Nor am I satisfied that Mr. Hudson's explanation of the function of coatings is the correct one. It seems more likely that they form a hardened crust just before fusion which retreats at a little slower rate than the iron, thus forming a crater which directs the globules downward and partially protects the molten steel, which is still on the electrode, from excessive oxidation.

Owing to the fact that the electrode passes thru a short hot zone before fusion, it does not seem likely that any surface change due to drawing or heat treatment could have any effect upon the melting point of the electrode surface, and the presence of rust or scale, unless it were very thick indeed, could aid very little in producing the result claimed.

The most important thing, of course, is to produce a sound weld and the blow holes produced in the weld itself are probably formed by the same reaction between dissolved carbon and oxides of iron, either finishing a reaction that was allowed insufficient item to complete in the electrode globule, or oxidizing the carbon in the fused portion of the plate. Both of these reactions probably take place as is evidenced by the fact that most of the globules thrown off on one side monoxide, is the gas which does the work. My belief is that at ordinary temperatures a considerable amount of gas is occluded by all solids and that this occluded gas is released at approximately the temperature of fusion. This is certainly true in the case of copper and apparently it is true in the case of steel. However, the question of what the gas is which produces the propulsion of melted particles across the arc is a matter of quite secondary consideration. Further investigation will determine whether this gas is carbon monoxide or vaporized sulphur or occluded nitrogen and oxygen from the air. The essential step made by Prof. Hudson is that some gas is developed by the very rapid increase in temperature which by its almost explosive action drives the small particles of steel across the arc. This action



Some of the Officers and Directors of The American Welding Society. Left to Right, Standing: C. A. McCune, Director; W. J. Jones, Director; A. M. Candy, Director; E. L. Mills, Director; Hermann Lemp, Director. Left to Right, Sitting. C. A. Adams, Junior Past President; J .W. Owens, Vice-President; J. H. Deppeler, President; M. M. Kelly, Acting Secretary; W. E. Symons, Treasurer.

are hollow, as Mr. Hudson points out. It has been my experience that a carbonless plate or one which has been decarbonized on the surface of the V will give a sounder weld than one having fairly high carbon.

J. C. Lincoln:—I think that the American Welding Society is to be congratulated upon having presented to it at its first meeting Prof. Hudson's paper on the theory of the electric arc. I am convinced that he has discovered the fundamental reason as to why metal is transferred across the arc from the electrode to the plate. I am not so certain that the particular gas which he mentions, namely, carbon is even more noticeable when working with the carbon arc than when working with the metallic arc. The writer has had occasion for the past two years to do a great deal of experimental work in connection with the carbon arc and some of these experiments have consisted in welding with a pulverized flux along the seam to be welded. The temperature of the carbon arc is higher than the temperature of the metallic arc, consequently, the development of the gas in accordance with Prof. Hudson's theory could be expected to be more violent. The facts are that the development of these gases is sufficient to produce a very noticeable draft, great enough in a great many cases to blow away the pile of flux

from the line of the weld. In fact, in order to get the flux properly applied to the seam to be welded it has been necessary to develop a process for applying this flux in a melted state rather than in the form of a powder.

The draft from a carbon arc of 200 or 300 amperes is under certain circumstances great enough mechanically to partly blow the arc out. I have seen this gas produce a flame at least 2 inches long under some circumstances. Apparently in the carbon arc there is under some circumstances a development of gas sufficiently rapid to produce a high singing noise. While the question has not been fully answered, it is my opinion that this singing noise is produced by the gas developed in the metal in accordance with Prof. Hudson's theory under some circumstances.

In the carbon arc metal is transferred from one side of the crater to the other in somewhat the same way that metal is transferred from the electrode to the plate in the metallic arc welding and in the case of the carbon arc the metal is actually propelled one-half to three-quarters of an inch by this action from the side of the crater which is being melted to the other side of the crater in which the metal is being frozen. The particular question in carbon arc welding is to make this action steady and continuous enough to produce a smooth weld instead of having the melted metal shot from one side of the crater to the other in a lump. The mechanical action of the gases developed in accordance with Prof. Hudson's theory is, I believe, very much greater in the carbon arc due to the higher temperature than in the metallic arc, for, as stated above, with the carbon arc the metal is propelled from one-half to three-quarters of an inch, while in the metallic arc the metal is propelled not over one-sixteenth of an inch.

I hope that the discussion will bring out more in detail the nature of the process which occurs in welding and I am sorry that I cannot state exactly the nature of the gases which produce the propelling action in the case of the carbon arc.

O. A. Kenyon:—Professor Hudson's explanation of the transfer of metal from the electrode into the joint is the most plausible one that has come to my attention. A number of years ago in discussing the matter with Dr. Charles P. Steinmetz, Dr. Steinmetz gave it as his opinion that the transfer of metal was due to a heat blast caused by a difference in temperature between the electrode and the work. Prof. Hudson's theory seems to bear this out, adding many details to the actual process by which the transfer occurs.

The working theory which I have used in the solving of welding problems fits in very well with the observations of Prof. Hudson, as far as practical results are concerned.

Experiments on the melting rate of electrodes, all conditions remaining constant except the current, demonstrated that the rate of melting of an electrode was a function of the current to the practical exclusion of the voltage. According to the heat blast theory, this would also follow, since the heat which causes the blast is produced by the current in the electrode and not by the current in the arc stream where most of the voltage is consumed.

Starting with the assumption that the rate of melting is determined by the current, it follows that any heat put into the metal after it is melted is unnecessary, and should therefore be limited as much as possible. In other words the arc should be kept as short as possible. A short arc also has the advantage of exposing the metal stream less to the action of the atmosphere, and of directing it more accurately into the crater of the work.

With these characteristics in mind, I devised the closed-circuit system, which provides a constant-current through the arc, and automatically limits the length of the arc, independently of the operator. The constant-current produces a constant flow of metal and thus greatly facilitates the actual holding of a constant length of arc. Wherever the current varies with the length of the arc, there is a tendency for the welder to see-saw.

Another point that seems to be borne out in this investigation is that a certain amount of carbon in the welding pencil is advantageous, as it furnishes gas for the heat blast. Previous to 1915 we had used Swedish iron almost exclusively, employing a flux coating in all cases. In this flux coating we put various metallic oxides, with the idea of refining the metal and producing a high strength weld. However, by accident, we found that a soft steel wire with about 18 point carbon flowed smoothly in the arc without use of a flux and gave us a stronger weld. It was our idea that the carbon in some way assisted in the heat generation, but we had no satisfactory explanation of its effect. Tests also showed that there was no perceptible relation between the quality of welding and the amount of carbon in the electrode over a wide range of variation, such as from 12 point to 25 point. Above 30 point, the electrode became practically explosive and holding an arc was impossible. All this experience is easily explained by Professor Hudson's theory.

As regards future trend, I personally do not favor the use of fluxes or coverings, as my experience has shown that covered electrodes usually produce porous spots at irregular intervals, due to the incorporation of impurities in the body of the weld. I also think that the physical structure of the electrode is of more importance than its chemical composition.

At one time we collected defective electrodes, by having the welders throw aside every electrode which did not consume smoothly in the arc. Comparing these electrodes with the others of the same chemical composition which did consume smoothly, it was found that the end of the good electrode presented a smooth rounded surface where the arc had been; while the poor electrode contained minute holes and many times was swollen like a fungus-growth and filled with small holes. Microscopic examination of these electrodes showed that the poor specimens always contained mechanical flaws, due to slag inclusions, or to pipes.

A pipe which has been welded together at intervals in the hot rolling process forms a series of closed pockets which contain gas. As the active end of the electrode approaches these pockets, the gas within them is heated, and the moment the end of the pocket is opened by the action of the arc, the gas blows out and often extinguishes the arc.

Although these experiments were all of a very practical and crude nature, nevertheless, they consistently indicated that a soft steel which is worked in such a way as to produce a uniform microscopic structure free from slag inclusions and mechanical flaws, will give as good result as can be wished for in the welding of iron and steel when a short arc is used.

William Siebenmorgen:—In reference to Prof. Hudson's paper, the theory suggested is very plausible. It surely explains overhead welding in a simple way. The one thing which has never been explained satisfactorily is the fundamental difference in welding when current is "reversed" presupposing that a certain direction of current is standard, viz., negative polarity for the electrode. When electrode is made positive, weld sputters will not bite. If welding overhead is tried in that case no success is had. If the theory will readily explain these phenomena it will do a great service.

C. J. Holslag:—As suggested by Mr. Hudson, the older theories, giving as explanation, electron, and ionic flow, etc., in the direction or the opposite direction to the flow of the current, were made to appear rather foolish by successful welding with alternating current, and it is time that a more up-to-date stylish theory is advanced. Mr. Hudson has

GENERAL WELDING & EQUIPMENT CO.

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EQUIPMENTS FOR WELDING AND CUTTING

PASSED BY THE UNDERWRITERS LABORATORIES CHICAGO, ILL.

TESTED BY THE BUREAU OF STANDARDS WASHINGTON, D. C.

WE ARE NOT HANDICAPPED BY BEING THE OLDEST CONCERN IN THIS LINE OF BUSINESS, NEITHER ARE WE THE LARGEST, BUT WITHIN A FEW YEARS WE HAVE BUILT UP A REPUTATION SECOND TO NONE FOR QUALITY AND SIMPLICITY IN CONSTRUCTION, FOR ECONOMY IN OPERATION, FOR REASONABLE PRICES AND FOR THE CONSIDERATE SERVICE WE FOLLOW UP WITH.

evolved such a theory, and, because it agrees with the facts as we see them, he is, no doubt, right. At least this theory, as do all other theories, will exist until something better is promoted.

That the metal goes over when welding correctly, i. e., short arc, as an invisible vapor, can be seen with any ordinary welding screen, and that large globules only appear as mistakes and defects in welding. The vapor consists of small particles, and the smaller the better, and the size varies directly as the length of the arc. Some of the metal must be gasified at the high temperature, collecting by condensing in the puddle as evidenced by the pure iron arc, the electrical phenomena of it being those of a gas as shown by oscillograph or simple meters. All of this gas, however, does not get into the completed weld. Tests have been made along these lines, weighing the plate with all substances in and out of the weld before and after welding, and subtracting the difference of the original weight of the electrodes with the weight of the plate, and from 2½ to 7½ per cent was unaccounted for otherwise than as having been passed off as a gas, no doubt, partially at least, as oxides and perhaps nitrides, as nitrogen, usually chemically inert, appears to wake up at the high temperature of the arc.

Mr. Hudson's simile of the high temperature of the gas and the non-melting of the projectile is hardly similar in size and mass action to the small particles of electrodes present at any instant in the arc. If Mr. Hudson means in his statement that it is impossible to weld with an electrode containing practically no carbon in a reducing atmosphere, that a good weld cannot be made, he is, no doubt, correct; but, if he means that the arc cannot be held and metal not deposited in fusion, our experience has shown otherwise. It would appear that he means the latter, as later on in the paper, he says the effect of welding in the reducing flame makes for more ductile welds, with less formation of nitride.

The conditions affecting the character of welds are so complex that quantitative analysis is almost necessary and this is practically impossible at present. For instance, the gas welder is careful to get his flame neutral, or very slightly oxidizing, so as not to deposit pure rust instead of pure iron, or to burn the metal. This is true also of arc welding, but is not so apparent, as the smothering action of the gases evolved excludes most of the air constituents, and simply the oxygen, nitrogen, etc., in the electrode or the plate (which latter I think has been pretty generally neglected) are the constituents to favor or ruin the weld. The arc itself makes ozone more oxidizing than oxygen by reason of its third molecule, and many people are of the opinion that it is either oxides or nitrides that make welds brittle, and both should be prevented as far as possible. This theory cannot very well be reconciled with the statement of good welds having been obtained with an oxidizing flame. It may be a slight amount of oxidation, especially with carbon present in the steel occurs with the constituents melting at the lower temperature than iron, which action as a sacrifice saves the iron particles.

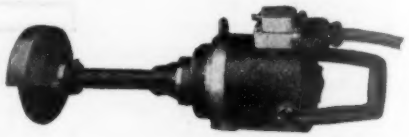
There are at present two distinct methods of coatings to improve welds. One school has it that the air and all oxidizing influences must be excluded, and do so by means of an inert sleeve around the arc, which results in a physical covering afterwards. This is evidently futile if the oxygen or nitrogen or other beneficial influences are deliberately kept within the sleeve, and hence end up in the weld. For instance, the ozone may be deliberately kept within the weld, and according to Professor Hudson this may be a good thing, and he is probably right, qualitatively. However, the obvious limit of this theory would be such an oxidizing influence that no iron was left. This would explain both good and poor results with this type of electrode, and how to ensure consistently perfect results is as yet impossible.

Another system of bettering welds is to furnish chemicals in or as a coating on the rod, which attack the undesirable elements and further the formation of the conditions desired. A further benefit from certain constituents within or as a coating on the rod is, beside the change of melting point temperature, the lowering of the contact gas path between the electrode and the work by means of the cathode, thus giving off electrons at a lower temperature than with pure iron. This is important, as there is a limit with pure iron for the temperature at which the arc can be held, and for certain classes of work it is desirable to use less heat where it would otherwise be impossible to hold an arc. This appears to be a much wider field for improvement than physically protecting the constituents naturally left in the electrode or plate, and once given the analysis of the electrode and plate the attacking agents can be modified to suit. This is the method of improvement along which we are working hard to progress, but it may be that our investigations, being almost entirely with alternating current, our solution would not be the general solution, as we are beginning to see there are real differences between the alternating and direct current arc which do not at all react against the A. C. arc for welding.

We cannot agree with Mr. Hudson's conclusions that rusty wire furthers the chances of good welding.

GRINDING FOR DRESSING WELDS

Our attention has recently been called to alternating and direct current aerial grinders developed by The Van Dorn Electric Tool Company of Cleveland, Ohio, particularly suited for dressing off the overflow metal along the welding line.



These two grinders are each suspended on a spring with twelve inch extension and 6" x 1" x ½" guarded wheel.

The D. C. grinder and 3-phase A. C. grinder are ½ H. P. and the single phase A. C. grinder is ⅓ H. P. AIEE Rating.

In all three types the end plate and extension spindle housing are made of steel. In the D. C. type the motor housing is also steel but in the ⅓ H. P. and ½ H. P. A. C. types this is constructed of aluminum to keep down the weight.

Both types are completely equipped with ball bearings of liberal size to insure running ease and assure that all the power is used in the cutting face of the wheel.

The shaft is locked to the inner races of the ball bearings to provide end thrust and legitimate shaft wear.

These tools are adapted for all kinds of light grinding and for dressing off arc welding of window and door sash in passenger car building, polishing, etc.

The Atlantic Welding Works have opened a well equipped shops at 30th and Spring Garden Sts., Philadelphia. The equipment includes a portable DC arc welding set, as well as gas equipment. The owners are Percival van R. Harris and John D. Reynolds.

Keep the Guess-Work Out of Welding

Go out into your shop, light up an oxy-acetylene torch and adjust your valves until you have a neutral or true welding flame. Hand the torch to any welder and ask him—"How is that for a correct flame?" Then you make a bet that he will change your adjustment, and you will win 498 times out of 500. We know. We've tried it much oftener than 500 times.

It isn't just natural contrariness that makes every welder change every other man's flame adjustment. It is because men in different shops are taught different adjustments—taught to use different pressure ratios, and not two in a hundred know *why* they use certain pressures. Lots of foremen, lots of superintendents, lots of engineers don't know why certain pressures are specified for tips of certain sizes.

Pressure has but one function—to give the gases sufficient velocity to prevent backfiring. Pressure has nothing to do with a correct flame or a correct weld. Without a correct *mixture* there can be no correct flame—no correct weld, and there has never been any reliable, uniform guide to a correct mixture. There has never been *any* guide except a man's visual judgment, and you can prove to yourself in two minutes that no two men have the same visual judgment. You can prove that ten men on identical work, with identical torches and tips are likely to have ten different pressure ratios and ten different gas mixtures, and that means ten different qualities of welds.

This is not said in criticism of the welder. It is a wonder he does even as well as he does, with no guide except his eye, often seriously affected by the bright rays from his flame, but the real wonder is that the seriousness of this matter of mixture has not struck home to every welding shop official, because every cubic foot of oxygen you use in excess of your combustible gas to obtain a neutral flame is not only wasted but is detrimental to your welds.

The answer is a Hydrex Flow Indicator. Write for complete information about this wonderful and efficient instrument.

Hydrex Engineering Corporation

73 West Eagle St. **Buffalo, N. Y.**

GAS WELDING SCHOOLS

California

Heald's Engineering & Automobile School, 1220 Post St., San Francisco, Calif., Mr. W. B. Perdue, instructor.

Held's Business College, San Francisco, Calif.

Pacific Automobile & Engineering School, 337-341 Golden Gate Avenue, San Francisco, Calif., Mr. O. L. Green, instructor.

Polytechnic Evening High School, West Washington & Hope Streets, Los Angeles, Calif., Mr. H. H. Winn, instructor. Science of Welding, Mr. J. W. Potter, instructor, shop practice.

Polytechnic Evening High School, 440 West Washington Street, Los Angeles, Calif., Mr. V. Kersey, instructor.

Colorado

Young Men's Christian Association, Denver, Col., Mr. Earl J. Thompson, instructor.

Illinois

Lane Technical High School, Sedgwick & Division Streets, Chicago, Ill., Mr. George J. Coleman, instructor.

Kansas

Knights of Columbus, Free Night School for Ex-Service Men, 412 Jackson Street, Topeka, Kan., Messrs. L. J. Becker and Jesse Farris, instructors.

Kentucky

Young Men's Christian Association, Automobile School, Louisville, Ky., Mr. S. B. Martin, instructor.

Michigan

Cass Technical High School, Detroit, Mich., Mr. Early, instructor.

Detroit Institute of Technology, Y. M. C. A., Detroit, Mich., Mr. L. B. King, instructor.

Industrial Fellowship League, Flint, Mich., Mr. Albert Sobey, instructor.

Michigan State Auto School, Detroit, Mich., Mr. Maxwell, instructor.

University of Michigan, Ann Arbor, Mich.

Young Men's Christian Association, Detroit, Mich.

Minnesota

Dunwoody Institute, Minneapolis, Minn.

Minneapolis Auto & Tractor School, 226-228 N. 2nd Street, Minneapolis, Minn., Mr. H. W. Adams, instructor.

Modern Auto & Tractor Schools, Inc., 2512 University Avenue, St. Paul, Minn., Mr. M. Marcott, instructor.

Motor Institute, Inc., 2628 University Ave., S. E. St. Paul, Minn.

The William Hood Dunwoody Industrial Institute, 818 Superior Blvd., Mineapolis, Minn., Messrs. P. Gagnon and C. K. Rickel, instructors.

Twin Ports Auto & Tractor School, Duluth, Minn.

United States Welding Co. School, 120 N. 1st Street, Minneapolis, Minn., Messrs. C. K. Rickel and B. K. Smith, instructor.

University of Southern Minnesota, Austin, Minn.

Missouri

Rake Auto & Tractor School, Kansas City, Mo. John McLeod, Instructor.

The David Ranken Jr. School of Mechanical Trades, 4420 Cook Ave., St. Louis, Mo., Mr. W. A. McCullom, instructor.

Nebraska

Lincoln Auto & Tractor School, 2415 O Street, Lincoln, Neb., Mr. T. L. Anthony, superintendent.

New Jersey

Davis-Bournonville Welding Institute, Jersey City, N. J., Mr. G. E. Harcke, instructor.

Oxweld Acetylene Co. (Welding School), 646-680 Frelinghuysen Avenue, Newark, N. J., Mr. John Hoffman, instructor.

Stevens Institute of Technology, Hoboken, N. J., Mr. A. S. Kinsey, Prof. of Shop Practice.

New York

Institute for Crippled and Disabled Men, 101 East 23rd St., New York City, Mr. James Walters, instructor.

Manual Training High School, 7th Avenue, 4th and 5th Streets, Brooklyn, N. Y., Mr. Wesley McArdell, instructor.

Young Men's Christian Assn., Bedford Branch, Auto School, 1121 Bedford Ave., Brooklyn, N. Y., Mr. F. C. Smith, instructor.

23rd Street Y. M. C. A. Welding School, 215 W. 23rd Street, New York City, Prof. A. S. Kinsey, supervisor.

North Dakota

Bishop Auto & Tractor School, Fargo, N. D.

Fargo School of Auto & Gas Engineering, 1225-1227 Front Street, Fargo, N. D.

Hanson Tractor & Auto School, Fargo, N. D., Messrs. Robertson & Noess, instructors.

Ohio

Automotive Trade, Court Street and Gilbert Avenue, Cincinnati, O., Mr. Paul Dilger, instructor.

Loyal Order of Moose (Welding Class), Dayton, O., Mr. Sid Osser, instructor.

Young Men's Christian Association, Dayton, O., Mr. Sid Osser, instructor.

Oklahoma

Oklahoma State School of Mines, Wilburton, Okla., Mr. J. R. Finch, instructor.

Utah

Hemphill Bros. Auto School, 360 E. 2nd South, Salt Lake City, Utah, Mr. James Cronson, instructor.

Utah Agricultural College, Logan, Utah.

Seattle Engineering School, Queen Anne and Roy Streets, Seattle, Wash., Mr. F. H. Reece, instructor.

William Juneau, 1017 Olive Street, Seattle, Wash., Mr. Juneau, instructor.

West Virginia

Wheeling High School (Manual Training), Wheeling, W. Va., Mr. Carpenter, instructor.

Foreign

Hemphill Trade Schools, Calgary, Alta., Mr. Hird, instructor.

Hemphill Trade School, Edmonton, Alta., Mr. Henn, instructor.

Hemphill Trade Schools, Regina, Sask., Mr. Towle, instructor.

Hemphill Trade Schools, Saskatoon, Sask., Mr. Baccon, instructor.

Hemphill Trade Schools, Vancouver, B. C., Mr. Buffen, instructor.

Hemphill Trade Schools, Winnipeg, Man., Mr. Hulton, instructor.

Montreal Technical School, Montreal, Que.

BOILER WELDING

Editor:

We have had considerable experience in welding in sections of side sheets, mud rings, door rings and smoke boxes on threshing engine boilers, also oil-well drilling boilers, with the very best of results, and at a great saving in time and expense to the owners, as compared with old methods of repairs. The welding of boilers can be done successfully by properly taking care of expansion and contraction, and the use of good materials.

Ramey and Garrison.

A Chicago Chapter of the American Welding Society will be organized early in June.

Announcing the

Wanamaker (Coated) Electrode

Essential to

Good Electric Welding

ELECTRIC Welding, in the hands of a good operator, produces strong, tough welds, if exposure of the molten metal to the air be avoided. Oxidation induced by such exposure, results in brittle and weak metal.

Users of metal-arc welding will, therefore, be interested in the WANAMAKER (COATED) ELECTRODE, which has just been placed on the market, after years of research and extensive private use.

The coating on WANAMAKER ELECTRODES melts evenly with the wire and forms a protecting envelope about the molten metal, preventing the formation of oxides.

The coating also insures smooth and uniform flowing of the metal, and permits of the use of larger electrode sizes than have heretofore been possible.

We solicit an opportunity to demonstrate the value of this product. Write us about your welding problems. We will be glad to help you solve them.

Locomotive cross heads and other heavy work may be successfully welded with Wanamaker (Coated) Electrodes

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"REGO"
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You can't get away from the fact that 93% of the REGO sales have been to large and experienced users of the oxy-acetylene process—men who are thoroughly familiar with the different types and makes of apparatus.

They purchased on the firm conviction of REGO superiority after the most thorough and severe tests.

These tests proved that REGO torches do more and better work on less gas consumption, operate satisfactorily under severest conditions and absolutely do not flashback.

In one of these welding tests, REGO torches increased production 15% and made a 9% saving in gases over competing apparatus.

In still another important test the REGO cutter showed a saving of $2.00 per hour on oxygen alone over a torch selling for twice as much.

Every month has added to REGO popularity. There are now thousands of experienced welders giving REGO their enthusiastic support.

REGO torches do exactly what we claim. Our advertising is a mere recital of facts.

REGO preference is based solely on REGO performance.

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"REGO"

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—Additional Representation Now Open

The addition of a modernly equipped new plant will within a few weeks increase our production to a point where we can supply additional distributors who are fitted to properly serve purchasers of welding and cutting apparatus.

The opportunity to become a REGO representative is a proven sales opportunity. Proven by our present large dealer organization.

We have a highest grade product, with which fact you are no doubt already familiar. We are starting upon a campaign of frank, honest publicity.

We have proven that it is possible to sell the very best welding and cutting apparatus on the same sound basis that prevails in other lines of manufacture.

Our experience, skill and equipment combine to produce quantity, with quality and economy.

The remarkable growth of REGO sales has been entirely due to its superiority.

REGO orders repeat—repeat orders insure profit.

REGO distributors are prosperous.

SSING COMPANY
LA SALLE STREET CHICAGO.

PRESS FRAMES

Editor:

I have noted in the February issue of *The Welding Engineer* what Mr. Morton has to say about welding press frame, etc. I also wish him the best of luck in his new business. But will have to take issue with him on cold welding of cast iron. We don't use that much abused term of expert welder, but we do know how to do welding that never comes back to us. If Mr. Morton doesn't preheat his work, some day some other welder will be saying what he said. It has broken through the other man's weld. I have welded twelve press frames in and near Utica, New York, and every one is holding up and has been in service from four months to three years. I had one break in the opposite bearing from the one I had welded. And it also made me feel proud to know what a weld would stand. So I made inquiries in regards to how it happened to break. The firm that owned the press also investigated the cause of the break and found that the press operator had two pieces of work under the dies at one time (an accident) one piece was half on the die and that was the side of the press that broke. So while I felt proud of my work, I still feel that if it had been on the welded side, the results would have been the same as it was on the broken side. Maybe this is what happened with Mr. Morton's job and the other fellow's also.

1 2 3 4

Only the man on the ground can tell the real cause. Enclosed is another press frame welded four months ago and working every day. (Next month I will have a lot of cast iron boiler sections for you.)

Photo No. 1—Is punch press as received by us. The head was completely broken off as you can see by photo. I clamped it back in place, punched and took tram measurements from five different points on each side, front and back. Also marked out the points of alignment that I wished to leave in after the chipping was all done. The gauge shaped air chisel we have found works the faster and best.

Photo No. 2—Press frame all chipped from one side. Note the extra heavy forged C clamps we have to hold our heavy work and parallel strips in inside of head, which with blocking placed under head prevents head from getting out of alignment when preheating fire is going. The alignment points were left in this shape. So when the bottom was welded they could be easily melted out. The bottom and half of the V on one side was welded, the casting was then turned over and the other V was done the same, except that the welding was finished, then turned back and finished the first side, in this way, the inside of the crack was finished when each turn over was made, also it keeps the heat almost equal in the casting and the weld as soft as the casting. Which was proven after we machined the large face of the side of the press. I didn't take a fraction of the preheating as no doubt it was the same as all others. Just fire brick placed to conform with the shape of the casting at hand.

Photos 3 and 4—Shows both sides of the press frame after the welding was done. The frame marks and measurements were exactly the same as they were before welding the casting. When the crank shaft was put in place they did not even put in a shim to line it up. It was perfect and has been working every day since.

Newell Welding Works

COSTS IN WELDING

In discussing welding costs, Capt. D. Richardson, Acetylene & Welding Journal, London, says:

"Some form of cost card should be kept where welding is carried on, not only for record purposes in case of a dispute but in order to obtain a history of a large variety of work which will be found to be of great assistance in determining a price where a customer desires it. The average small shop is not usually run with the proper attention to the real cost of the work. Few welding shops properly take into account what is known as overhead costs. Such expenses as interest, depreciation, insurance, repairs, taxes, advertising, soliciting, telephone, insurance, repairs, etc., have to be paid out of the earnings of the shop. A large concern with competent accountants look after these items and realize that its customers have to pay for them in the price of the work.

The cost of gases is, for example, frequently taken at the invoice price, without considering the cost of carriage and handling.

Assume that a plant costs £200, and that the fixed charges will be as follows:—Interest, 6 per cent; depreciation, 10 per cent; repairs, 5 per cent; insurance 2 per cent; taxes, 1 per cent; a total of 24 per cent or £48 per year. The operating expenses may be approximately: Rent, £7; heat, £1; light, 10/-; power, £1; a total of £9 10s per month of £114 per year. There will be miscellaneous charges such as files, chisels, hand tools, etc., charcoal, cartage and other things will run up to, say, £5 per month or £60 per year. If the welder is an all-around man, his labor will be worth at least 2/6 an hour. The total of these charges, exclusive of the welder's labor, amounts to over £220 per year. Assuming that the oxygen and acetylene costs 2d. per cubic foot, this covering carriage and handling, and that the average size blowpipe uses 25 cubic feet of acetylene and 30 cubic feet of oxygen per hour, the cost of operating the blowpipe apart from labor, will be about 9/- per hour.

To summarize: The cost per head based on 2,500 working hours per year will be as follows: Overhead, 1.8 shillings; labor, 2.6 shillings; gases, 9 shillings; a total of 13.4 shillings. It will be understood that the figures given are not actual and will have to be modified to suit expenses which will vary with different localities. Although the cost per hour may seem high when compared with, say, machine shop work, it should be understood that this is not the correct basis on which to make the comparison. The results obtained must be considered.

THERMIT WELDING TIMELY DURING FREQUENT BREAKDOWN PERIOD

March, 1920, has been one of the most active months which Thermit Welding has ever had, judging by the number of pounds of Thermit ordered from the manufacturer during that period which reached well over 200,000 lbs. This activity is partly due to the "peak" number of breaks of heavy steel equipment which generally occur around this time of year but is also due in a large measure to the fact that plants are more and more realizing the great savings possible by reclaiming machinery by this method instead of scrapping it as formerly.

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Metal Cutting and Welding Equipment

Victor Welding and Cutting Apparatus

VICTOR TRADE MARK
Metal Cutting and Welding Equipment

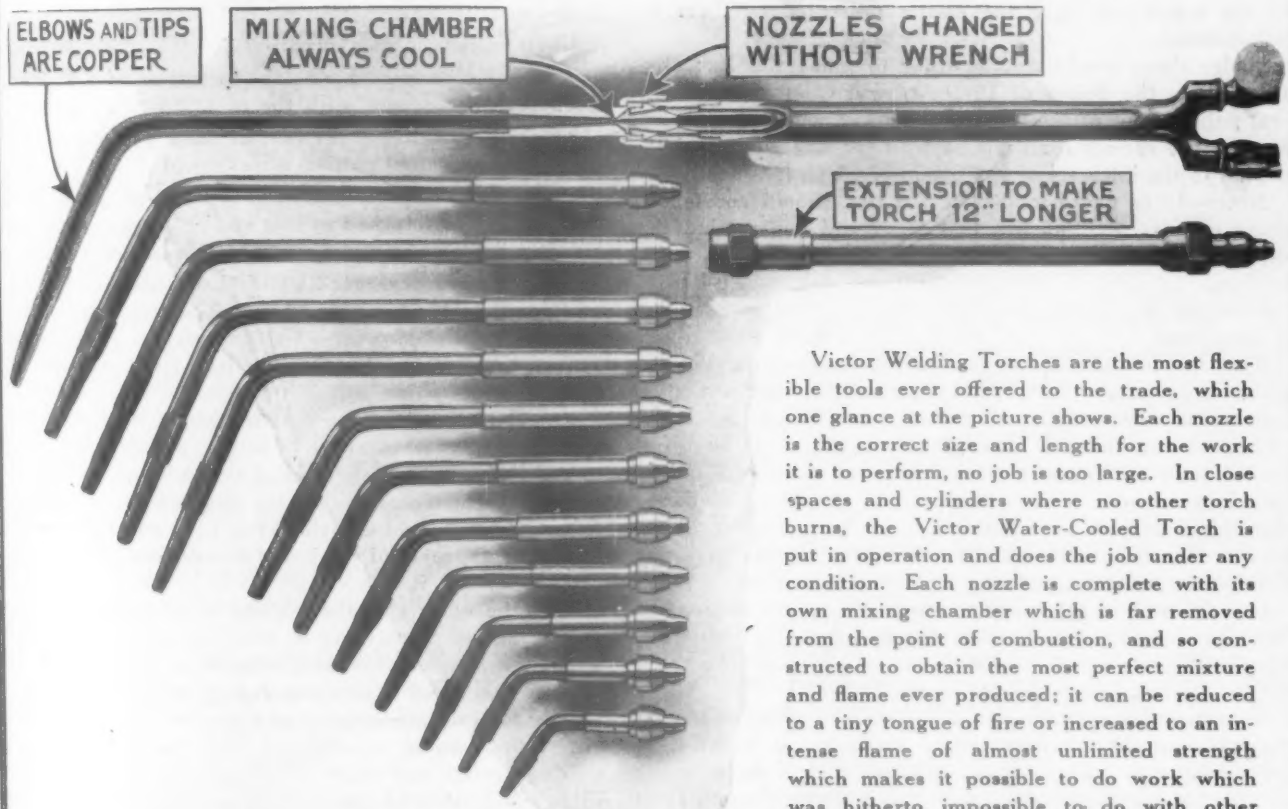
THE PRODUCT OF EXPERIENCE

The VICTOR OXY-ACETYLENE EQUIPMENT COMPANY have ready for delivery a complete line of Welding and Cutting Apparatus embodying the last word in improvements on torches. What is claimed for other torches is accomplished only by the VICTOR.

There is something which defies theory in the making of successful torches. No blue print specifications can foretell its performance. Engineering skill alone cannot assure it.

The successful torch is the product of years of experience under all operating conditions.

VICTOR Torches have GROWN to be what they are. They do the most work for the least money because that has been the essential purpose in their development.


ELBOWS AND TIPS ARE COPPER
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NOZZLES CHANGED WITHOUT WRENCH
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Victor Welding Torches are the most flexible tools ever offered to the trade, which one glance at the picture shows. Each nozzle is the correct size and length for the work it is to perform, no job is too large. In close spaces and cylinders where no other torch burns, the Victor Water-Cooled Torch is put in operation and does the job under any condition. Each nozzle is complete with its own mixing chamber which is far removed from the point of combustion, and so constructed to obtain the most perfect mixture and flame ever produced; it can be reduced to a tiny tongue of fire or increased to an intense flame of almost unlimited strength which makes it possible to do work which was hitherto impossible to do with other torches. Victor Torches consume equal amounts of each gas, and flashbacks are unknown. In speed the Welder with the VICTOR is racing away from all competitors. Once a welder has used the VICTOR all other makes are a thing of the past.

Valuable territory open to live agents.

Victor Oxy-Acetylene Equipment Company

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Minutes of the Meeting of Board of Directors of American Welding Society Engineering Societies Building, April 2, 1920

Meeting called to order at 9:45 A. M. by Chairman C. A. Adams with the following present: C. A. Adams, D. B. Rushmore, A. S. Kinsey, J. H. Deppeler, W. J. Jones, James Burke, W. E. Symons, C. A. McCune, Hermann Lemp. E. L. Radcliffe, representing L. H. Davis; C. E. McQuigg, representing J. M. Morehead.

Representatives from Philadelphia: W. W. Barnes, W. T. Bonner, H. J. Grow.

In order to facilitate the handling of the affairs of the society and to lessen the burden on the various members of the present Executive Committee and the Board of Directors, it was voted:

That the present Executive Committee be discharged and a new Executive Committee to consist of only three members, C. A. Adams, J. H. Deppeler and W. E. Symons, be appointed; that the Board of Directors delegate to this small and workable Executive Committee for the time being, its full power, with the understanding that the Executive Committee will immediately report by letter to every member of the board any action which it has taken and allow sufficient time for objection to such action before it is put into effect. Should the majority of the Board of Directors express objection, within a week, to any action which is taken, the president will then immediately call a special meeting of the board and have the matter presented to them for confirmation.

Under these conditions, in order to guide the Executive Committee, the Board of Directors will enunciate the general policies and principles to be followed, one of which will be that the society shall not be used for any purpose detrimental to the interests of any group of which it is composed.

Note:—It is understood that a letter should accompany these minutes pointing out that the board can rescind this motion any time, and also explaining the reason for the motion.

In order to give the treasurer the power of comptroller, it was voted:

That the treasurer (who is also chairman of the Finance Committee) be and is hereby authorized to exercise a close supervision over the incoming funds and expenditures thereof to the end that the expenditures shall not at any time exceed the actual cash in the treasury or its equivalent, and that in the event of any proposed or actual expenditures that might exceed the actual funds or its equivalent, it will be his duty to confer with the members of the Executive Committee before approving vouchers for same.

It is the wish of the board to bring out, by this motion the fact that no action can be taken by the Executive Committee which will involve the expenditure of any funds without having the previous approval of the treasurer.

In connection with the above motion it is understood that the treasurer will have authority to authorize the incurring of expenditures as well as their payment; that if there is any question of doubt, he can consult the other two members of the Executive Committee.

The treasurer presented a financial statement for the month of March and stated that expenditures to an amount of $853.76 had been made during the month of March, over and above the $500 allotment. This amount, however, covered items which had been approved by the board at a previous meeting. The board's approval of these expenditures was asked.

Upon motion, it was voted:

That the expenditures during the month of March, amounting to $853.76, be approved.

He then brought up the matter of the Philadelphia expenditures after Mach 1st, and after discussion, it was voted:

That the expenses incurred in Philadelphia as reported by F. W. Tupper in his report of March 17th, plus an amount not to exceed $250. Covering the period from March 17th to March 30th, making a total of $923, be approved for payment, all bills to be properly supported by endorsement.

The chairman brought up the question of re-employing F. W. Tupper to carry on membership work and upon motion, it was voted:

Whereas, at previous meetings on account of financial stringencies it seemed necessary to suspend the employment of Mr. Tupper; and whereas, the conditions having changed, it is now considered that to take advantage of these changed conditions to the greatest extent, it is advisable to re-employ Mr. Tupper on some basis for membership campaign work; the Board of Directors, therefore authorizes the employment of Mr. Tupper for membership campaign work in connection with the organization of the several sections on a commission basis as follows:

That he receive fifty per cent of the dues actually paid in by new members during his period of employment, it being understood that in any district this applies only to the dues received from new members in that district during his activity in that district.

Philadelphia Section

The chairman read the constitution as prepared by a joint committee of the A. W. S. Board of Directors and the Philadelphia Section and presented same for the approval of the Board of Directors.

Upon motion, it was voted:

That the society authorize the formation of a Philadelphia Section in accordance with the constitution as read.

The question of the division of dues was brought up for discussion and upon motion it was voted:

That fifty per cent of the dues of members in the Philadelphia district be returned to that section for its local expenses, the geographical limits of the distict to be defined later; also

That for this year one-half of that portion of the dues of all local members be returned, which corresponds to that portion of the calendar year which follows the date of organization of the section, also that one-half of the expenses of organization be borne by the section.

Note:—Copies of above motions with a brief statement regarding actions taken are to be sent to Mr. Brogden, chairman of the Philadelphia Organization Committee.

The chairman stated that the question of organizing sections in Chicago and Cleveland had been under discussion and asked the approval of the board to organize these sections.

Upon motion it was voted:

That the officers of the Society be authorized to assist in the formation of sections in any part of the United States, under the adopted standard form of constitution with variations to meet local conditions and to grant the necessary authority for the formation of said sections, and when possible the section should be affiliated with the local general engineering society and where practicable the organization work should be conducted from such society headquarters or at least from neutral headquarters.

The question of local representation on the Board of Directors was brought up and this matter was referred to our Constitution and By-Laws Committee.

The attention of the board was called to delinquent members and the opinion of the board was asked as to the manner of handling these members. Upon motion, it was voted:

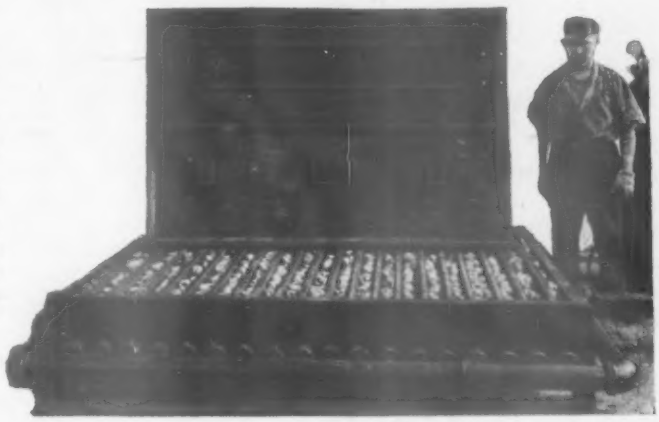
To appoint an Auditing Committee to audit the books of the society before the annual meeting and to have this Auditing Committee notify the members of their delinquency and ascertain whether or not they wish to be retained as members.

The chairman stated that it was necessary at this time to

DO YOU WELD CASTINGS?

If you weld castings, you have already realized that the question of satisfactory Preheating is of primary importance to obtain satisfactory results.

In spite of every precaution taken in your welding shop, you still find a large percentage of your output is, to some extent, "out of line" or that "hard welds" are a source of great trouble and expense in your machine shop.



This casting, four feet wide and six feet long, varying in thickness, was preheated, welded and cooled on a Wiederwax Preheater. Can you do this with your present method of preheating?

Uneven heating will destroy the work of the best welders.

The WIEDERWAX PREHEATER Has Revolutionized The Science of Preheating and Welding

combining, as it does, a preheating and welding table with an absolutely even distribution of heat over any desired surface, and over which the work may be turned with ease and welded at any point.

THE WIEDERWAX PREHEATER will give a greater and more evenly distributed heat than a well-prepared charcoal fire, or any other preheating method known, with perfect control at all times.

No making of fires—no watching—no blower required to operate the Wiederwax—no smoke—no fumes—no wasted fuel.

The maintenance is too small to mention. The cost of operation is less than one-half compared with other methods.

The WIEDERWAX PREHEATER is always ready for duty.
The WIEDERWAX PREHEATER can preheat anything.
The WIEDERWAX PREHEATER is the only reliable preheater on the market.

The WIEDERWAX PREHEATER will and does take care of from 90% to 95% of the work in all welding shops, foundries, or factories that are doing welding.

The WIEDERWAX PREHEATER will increase production from 15% to 25% where one is in use.

The WIEDERWAX PREHEATER is a Big Time and Labor Saver

GEIST MANUFACTURING COMPANY

Department X ATLANTIC CITY, N. J.

appoint a committee of tellers to count the election ballots. Upon motion, it was voted:

That the chairman appoint a Committee of Tellers to act on the election ballots on April 16th.

Mr. Wanamaker asked that a committee be appointed to confer with the chairman of Section 111 of the American Railroad Association as to co-operation between Section 111 of the American Railroad Association and the American Bureau of Welding. Upon motion, it was voted:

That a committee be appointed to confer with the chairman of section 111 of the American Railroad Association regarding the co-operation of the American Bureau of Welding and the Welding Committee of that section and that this co-operation be asked within the next few weeks.

The chairman stated that it was necessary to appoint a secretary to take the place of H. C. Forbes, resigned. He further stated that on account of lack of funds, the appointee would have to serve, temporarily at least, without salary. Upon motion, it was voted:

That M. M. Kelly be appointed secretary protem.

Meeting adjourned 2:00 p. m.

Respectfully submitted,

M. M. Kelly.

ANNUAL MEETING OF THE AMERICAN WELDING SOCIETY, ENGINEERING SOCIETIES BUILDING, APRIL 22, 1920

Morning Session

Meeting was called to order at 11:00 a. m. by President C. A. Adams.

Upon motion, it was voted: That the reading of the minutes of the first meeting be dispensed with.

President's Address

In his review of the first year's work of the society, the president brought out some of the handicaps under which this work had been done.

These handicaps were in part due to the taking over of the staff and expenses of the Welding Committee of the Emergency Fleet Corporation and an attempt to carry on the work on too generous a scale, and in part to such conflicts and differences of opinion as to policy as are common to nearly all new organizations. The more important of these conflicts were:

1. **Membership.** Some influential member of the Board of Directors wished the membership largely confined to the manufacturers of welding apparatus and supplies, and under their control. Had this opinion prevailed it is obvious that the society would have split up into two groups, gas and electric welding, owing to the conflict of interests. In fact, the growth in membership was for a time so throttled by the influence above mentioned, that such a split was seriously threatened.

However, there was a strong majority opinion in favor of a large society made up largely of users of welding apparatus and supplies, whose concern is with *welding* rather than with any one kind of welding and who want the *facts* in regard to all kinds of welding. This majority sentiment has prevailed. The society is now increasing its membership rapidly and is set for a campaign of service to the users of welding and to the welders themselves, all of which must reflect favorably on the manufacturers and the development of the art of welding.

2. **Proceedings.** After considerable discussion, it was decided to publish the proceedings of the society in a separate journal, provided sufficient advertising would be secured to pay for the publication. Unfortunately the printers' strike made it necessary to have the first number of the journal printed in Boston at a cost considerably above the New York estimate, with a corresponding deficit. This served as the basis for further opposition and delays until after most of the advertising contracts for the current year had been let.

It was finally decided to accept a very generous offer from *The Welding Engineer* to use it as the official organ of the Society. It is hoped that this will prove satisfactory to the membership.

Other Matters of Interest.

3. **Office Changes.** In order to keep the expenses within the prospective income of the Society without counting too largely on the prospective increase in membership, it was decided to reduce the scale of expenditures to a minimum. As a result we have lost the very valuable services of Secretary H. C. Forbes, who resigned on March 1st, and Mr. F. W. Tupper has been released. Mr. Tupper is now working on a membership campaign on a commission basis. Miss Kelly who has served the welding movement so loyally since the first organization of the Welding Committee of the Emergency Fleet Corporation has been appointed acting secretary.

4. **Executive Committee.** In order to avoid delays due to lack of a quorum at meetings of the Board of Directors and of the Executive Committee and in general to simplify the operation of the executive machinery, the Executive Committee was reduced to four members (Messrs. Deppeler, Adams, Symons and Mills) and given the full authority of the Board of Directors, with the understanding that its acts be transmitted immediately by letter to the other members of the Board of Directors, and that unless majority objection was received in one week, the actions were to have full force.

5. **Sections.** After a very large and enthusiastic meeting in Philadelphia on January 23rd, several influential Philadelphia members suggested the organization of a Philadelphia Section. After several conferences the necessary machinery was put in motion and it is now expected that this section will be organized about May 1st.

The Board of Directors have since then formally approved the organization of this and other sections and have prepared a skeleton constitution for the sections.

Enthusiasm has also been shown by our members in Chicago and Cleveland, and plans for a Chicago Section are already under way.

6. **In conclusion,** the President stated it was felt by those who had been in close touch with the work, that the Society had passed through the rough waters and there was now great promise of a large increase in membership, provided each member would take hold and assume his share of the responsibility in helping to build up the Society, not only in getting members, but by taking part in its other activities. Each member should consider it a first step to notify the office of his willingness to serve and of his particular interests, so that he can be given the opportunity when it arises.

Report of Finance Committee.

The chairman of the Finance Committee read the financial report and upon motion, it was

Voted: That the report of the Finance Committee be received and approved subject to the approval of an auditor.

Report of Meetings and Papers Committee.

The report of the Meetings and Papers Committee was read by the Secretary of that committee and upon motion, it was

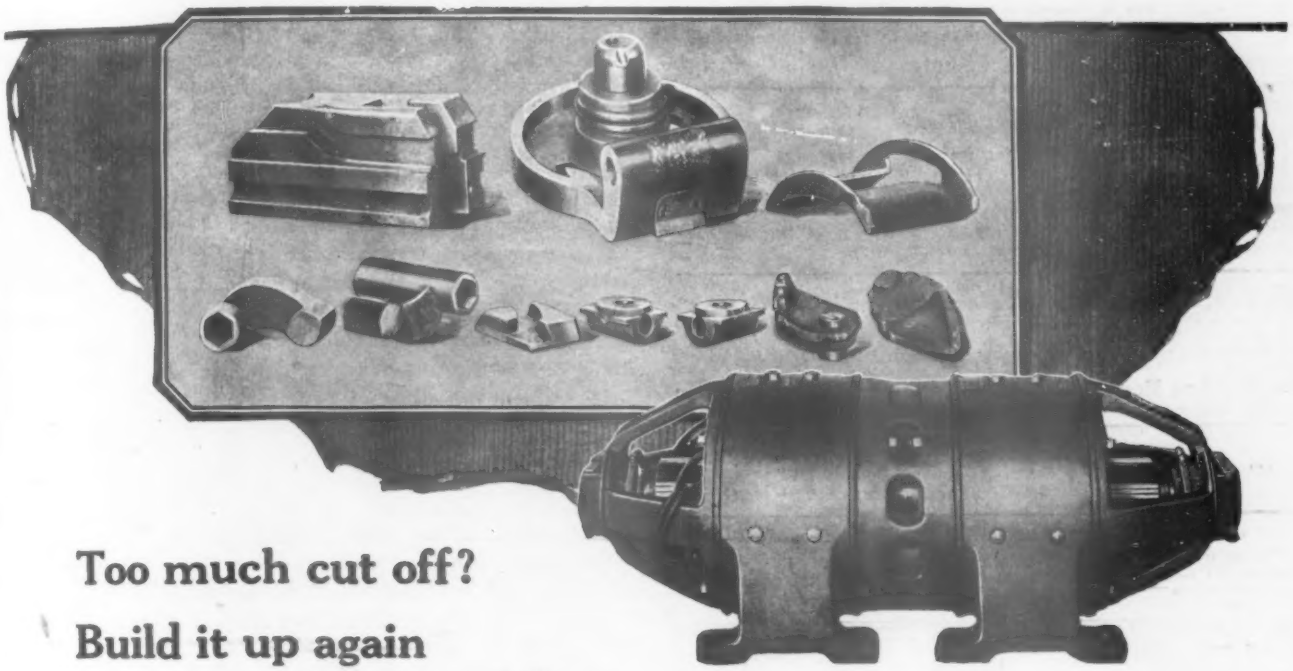
Voted: To accept the report of the Meetings and Papers Committee.

Report of Membership Committee.

The report of the Membership Committee was read by the

(Continued on Page 44)

Costly mistakes made in machining work requiring close accuracy are often rectified by arc welding



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Build it up again by arc welding

WHEN work, which must be very accurately machined, is cut under size, G-E arc welding outfits are often used to rebuild it to required limits.

The localized heat feature of G-E constant energy arc welding outfits makes this possible without harming adjacent metal, as oftentimes the work will be heat-treated.

The metal deposited by arc welding is easily machinable and free from porosity.

G-E constant energy arc welding outfits assure a steady flow of metal into the weld and operate at high efficiency.

Let us train your men to be efficient welders at our Schenectady school while your sets are being built.

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The Welding Engineer

Reg. U. S. Pat. Office.
Published on the 17th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephone Wabash 7134.

J. R. Mackenzie.....President and Editor

Subscription payable in advance and postage free.
United States and possessions and Canada and Mexico.....$3.00 a year
Foreign Countries ..... 4.00 a year
Single copy, domestic .....25 cents
Single copy, foreign .....30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

Last Advertising forms close at 8:00 a. m. on the 15th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails.

The Welding Engineer is a member of the Audit Bureau of Circulations, the Chicago Trade Press Association, and the Associated Business Papers, Inc.

The Welding Engineer is the official organ of the American Welding Society.

Eastern Office:
171 Madison Ave., New York. Telephone, Murray Hill 4394.
Max I. Barth, Eastern Representative.

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VOLUME 5. MAY, 1920. NUMBER 5.

A Government Job

THE United States Civil Service Commission announces an open competitive examination for acetylene welders. Applications should be addressed to the commission at Washington. The pay is $1,500 per year. Applicants will be rated on physical ability, training and experience.

We are inclined to think the pay offered will not attract the best class of welders and we are curious to know just what sort of an examination is to be given. The circular states that "Competitors will not be required to report for examination at any place, but will be rated on the following subjects," and the subjects are physical ability and experience and training.

At one time *The Welding Engineer* considered the question of conducting mail examinations, intending to issue "Proficiency Certificates." We never succeeded, however, in working out a satisfactory plan and if the Civil Service Commission has done so, we would like to know more about the plan.

Second Hand Equipment.

WHEN the Yanks busted up a perfectly good war (with every respect to our good friends and Allies, English and French) we feared for a time that there would be a huge amount of used welding equipment dumped on the market. Every manufacturer making things out of metal had plenty of equipment, and when the war orders stopped we thought this equipment might come on the market and seriously effect business. A large part of it, however, has come on to the market but it has been absorbed so gradually that there has been no visible effect on business. It is also true that many of the munition makers who, during the war, took up welding for the first time, are not profiting by the lessons learned through sheer necessity.

Arc Welding Schools

WE have a great many questions put to us about welding schools. We have a number, some of them doing very good work. We recently asked a large manufacturer of arc welding equipment for a statement about their Welding School, and publish herewith a part of the reply received:

"The less we say about our Welding School, the better. We have in fact changed its name from the welding school to the Welding Department, and we no longer claim to maintain a welding school. The reason back of this is that we tried maintaining a Welding School and have not been successful. The most we can seem to do is to get an expert commercial operator and put him in charge of the Department and put it up to him to systematically train operators. However, this is far from being a Welding School and what the operator learns is merely to hold an arc in horizontal, vertical and overhead position. He does not learn anything to speak of about the science or craft of welding. We found that when we called this Department a Welding School, the students came here with the expectation of learning considerably more about the process than it was possible for us to teach him. Hence we changed the name and kept on doing the same thing.

I have investigated other so-called schools, and find that they are up against the same proposition. About all that can be expected is that the prospective operator will learn how to maintain an arc. We cannot keep him here long enough to teach him the common sense and give him the experience in welding that really makes a good operator, and if we call our Welding Department a Welding School and turn him out anything less than a good operator, it means that the School so called, loses its prestige and reputation. So what we do is to tell our customers that we maintain a Welding Department and that we will be glad to give their man such instructions as it is possible to give in our Welding Department, and so far most of the students have left satisfied that they really learned something, but while we were running the school, about 95 per cent of the men who came here to learn welding went away disappointed because they did not learn what they expected to.

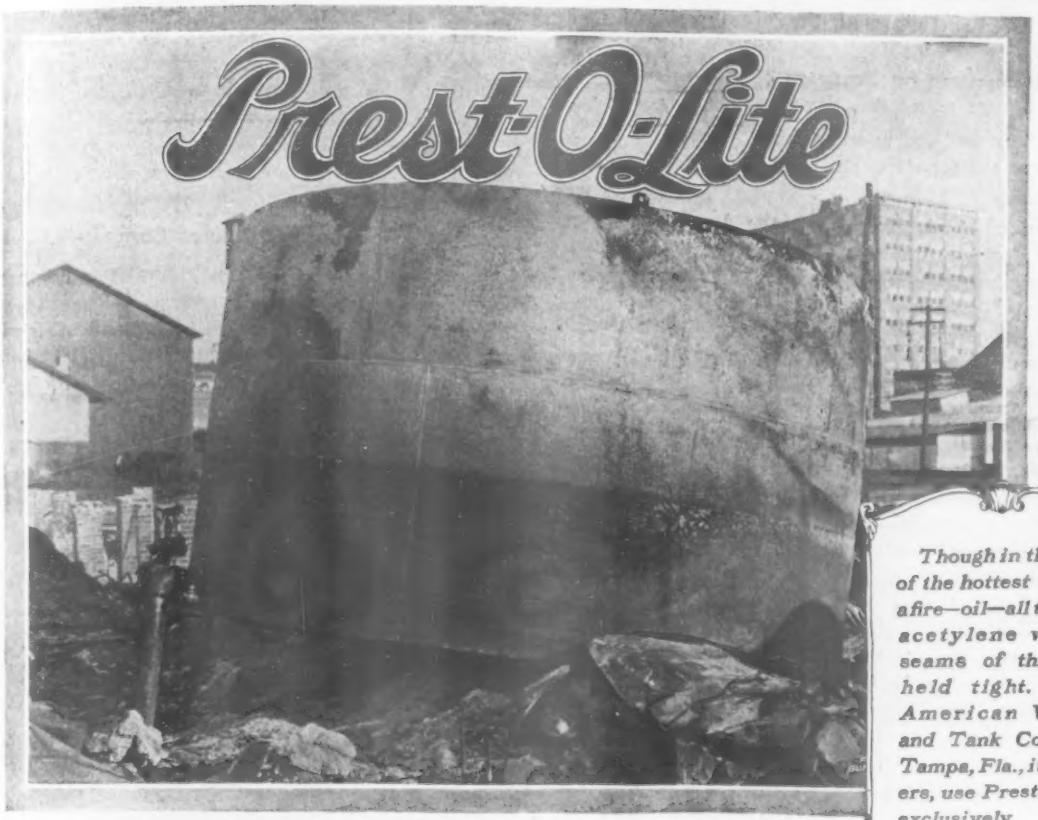
We make no charge for putting a man through the Welding Department. We merely ask him to deposit $10.00 to insure us against loss of tools. We try to get a man to stay at least three weeks in the Welding Department. We have only day work and do not operate the Department at night.

During the life of this Department, it is my belief that we have turned out about 150 men, and they seem to get along pretty well. We have taught welding to everything from barbers to bartenders and it is a straight fact that once they get started welding they usually stick to it and make good.

I think it would be a good thing if everybody would quit calling their Welding Department a Welding School, since there is no getting away from the fact that you cannot teach the really important part of welding in any school in the length of time that a man can afford to spend in the school. There is only one way that a man can learn welding, and that is by experience and by the constant application of common sense to his work. The assumption is that a Welding School turns out expert welding operators. Obviously, this is impossible. Hence it is my belief that we should, all of us, stop calling the Welding Department a Welding School."

NEW INSTRUCTION BOOK

"Instructions for Welders" is the title of a new phamplet just isued by the General Welding & Equipment Co., 107 Mass. Ave., Boston.



Though in the heart of the hottest kind of a fire—oil—all the oxy-acetylene welded seams of this tank held tight. The American Welding and Tank Company, Tampa, Fla., its builders, use Prest-O-Lite exclusively.

A TANK THAT COULDN'T BE PUT OUT OF BUSINESS

This 12,000 gallon oxy-acetylene welded oil tank is practically *all* that was left of two burned-down business blocks in Tampa, Florida.

Not only did it withstand terrific heat, but also the shocks of dropping five feet and of having roof and floor beams crash upon it.

The ruggedness of this tank is another tribute to

Prest-O-Lite
DISSOLVED ACETYLENE

THE UNIVERSAL GAS WITH THE UNIVERSAL SERVICE

as an important factor in the efficiency of the oxy-acetylene process.

The domed head was bent in, the 5 inch oxy-acetylene welded supply pipe held fast—***without a leak***—despite the fact that half the weight of the tank hung upon it, even after all the dents were straightened out the welds held tight.

You will be interested in the Prest-O-Lite Service Plan. Write us about it.

THE PREST-O-LITE COMPANY, Inc., General Offices 30 East 42nd Street, New York
Kohl Building, San Francisco
In Canada—Prest-O-Lite Co. of Canada, Limited, Toronto

PW-501

(Continued from Page 40)

chairman and upon motion, it was

Voted: To accept the report of the Membership Committee.

Report of Committee on Program of Activities.

The report of the Committee on Program of Activities was read by the chairman and upon motion, it was

Voted: To accept the report of the Committee on Program of Activities.

Consideration of Amendments to the By-Laws.

1. The President read the two amendments to the By-Laws since the first meeting and asked that some action be taken by the Society on same.

   a. Article VI, Section 4, to read "* * * and ten (instead of twelve) Directors shall constitute a quorum at meetings of the Board of Directors."

   Upon motion, it was

   Voted: That this amendment be confirmed.

   b. Article VII, Section 1, add the words "not otherwise entitled to vote" to read "voting by proxy shall not be allowed at any meeting of the Society, committees, except by personal representative, not otherwise entitled to vote."

   After discussion, it was

   Voted: To recommend to the Constitution and By-Laws Committee that Article VII be changed to read.

   Article VII.

   Section 1, Voting by proxy shall not be allowed at any meeting of the Society, its Board of Directors or of any of its committees, except by personal representative at the particular meeting stated, not otherwise entitled to vote.

   Section 2, representation by proxy in any meeting of the Board of Directors is limited in that the proxy may be accepted or repected by the majority of the members present and the absent member must accept their decision.

2. Discussion of other amendments to the By-Laws.

   a. The President read votes passed by the Board at meeting on April 2nd relative to the organization of sections and upon motion, it was

   Voted: To authorize the organization of sections according to the actions taken by the Board of Directors at its meeting held on April 2, 1920.

The question of the proportion of dues to be returned to the local sections was brought up and upon motion, it was

Voted: That the question of the proportion of dues to be returned to the different local sections, together with instructions as to a campaign for membership, be left at present with the Board of Directors and Executive Committee, in as much as it is a matter which needs to be given special consideration for each locality.

The question of local representation on the Board of Directors was next taken up and upon motion, it was

Voted: That the Society recommend to the Constitution and By-Laws Committee, in the revision of our Constitution and By-Laws, they make provision on the Board for a member from each local section, elected by them as such, with the title of Vice-president.

b. Two further amendments to the By-Laws relative to changes in classes of membership were brought up for consideration:

1. To confer voting privileges on the Class D membership. Upon motion, it was

   Voted: To recommend to the Constitution and By-Laws Committee that they take into consideration, granting the privilege of voting to Class D members on Local Section matters, but not Society matters.

2. To change the Class C membership so as to allow associate members the privilege of voting and to make this class available to first-class welders, inspectors, etc. Upon motion, it was

   Voted: To recommend to the Constitution and By-Laws Committee that the Class C membership be changed to read:

   Class C, associate members with right to vote, but not to hold office, $10.00.

Report of Tellers Committee.

The chairman of the Tellers Committee announced the election of officers for the year 1920 as follows:

President ..... J. H. Deppeler.
Vice-president (two years) ..... J. W. Owens.
Vice-president (one year) ..... D. B. Rushmore.

Directors—Three Years.

W. M. Beard.	C. A. McCune.
A. M. Candy.	S. W. Miller.
C. J. Holslag.	M. H. Roberts.
W. J. Jones.	P. F. Willis.

Upon motion, it was

Voted: To accept the report of the Tellers Committee and to declare the above named officers elected.

Attention was called to a vacancy in the Board made by the resignation of M. H. Roberts and upon motion, it was

Voted: To recommend to the Board of Directors that Mr. Joah Brogden, of the David Lupton Sons Co., of Philadelphia, be elected to fill the place of M. H. Roberts, resigned.

In recognition of the untiring efforts of President Adams in bringing the Society through a year of struggles on account of the difficulties which endangered its existence and in now getting it started in the direction of accomplishing the purpose for which it was originally intended, it was

Moved by Mr. Lemp, seconded and unanimously passed, that a rising vote of thanks be given to President Adams.

Meeting adjourned at 1:00 P. M.

WELDING IN CUBA

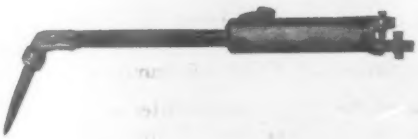
The Welding Engineer has recently received a letter from an American welder who has been in Cuba for some time. His comment upon the welding situation in Cuba is interesting and is as follows:

"We find in Cuba at present very few real good acetylene welders possibly fifteen experts in all of Cuba and some of these are specialty men. We find them working and studying very hard to try and comprehend a process which to them is all new light. The Cuban, however, has many things in his favor. He has a good idea of contraction and expansion and is exceptionally handy with his hands. These features are a big help along the way of making a good scientific welder. If the Cubans were only a slight bit more intelligent, we could develop experts here in a few months. What we need here are a few real fine experts but this is impossible because few experts care to go to a foreign country and study a new language. Then too, it is extremely hot for a welder all the year round and the pay here is much less than in the U. S. A. and living expenses about triple.

If we could only establish welding schools here, we could develop welders much more rapidly but owing to the fact that the larger towns are so far apart that the mechanics could not study unless a school were established in every little hamlet. However, a school in a city like Habana might be of great assistance to the Cuban welders.

I believe that in time, Acetylene Welding or "Soldadura Autogena" as the Cubans call the process, will be as popular and as much used as in any section of the United States.

MILBURN Oxy-Acetylene Apparatus



THE four factors that produce results in your manufacturing are management, men, materials and equipment. But no matter how good the first three, without proper equipment you cannot produce proper results.

It makes no difference what the nature of your work or the kind of equipment necessary, you can get most efficient results by using Milburn products. From the finest jeweler's or dentist's torch up through heavy welding and cutting torches to the largest industrial acetylene generator plants, Milburn equipment is superior.

There is a uniformity of efficiency in Milburn apparatus which is remarkable. For heavy welding work best results are obtained with Milburn type J torches. They operate with a clean, uniform flame, resulting in clean, uniform work. Also, in the finest jeweler's torch you will find the same efficiency. A small Milburn torch is not merely the little brother of the heavy torch. Its design has been carefully and individually worked out, so that its results are most highly efficient.

It makes no difference what apparatus or equipment you need, specify Milburn and guarantee to yourself best results. Write for the Milburn catalogue No. 22, showing the complete Milburn line.

Milburn welding and cutting torches are covered by U. S. patents and the Alexander Milburn Company guarantees full protection to vendors and users of its products.

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AN ELECTRIC WELDED BUILDING

By H. B. Payne*

The interesting thing about electric arc welding is not so much the method which is employed, but rather the constantly widening application of it as an industrial process.

Since the discovery of electric arc welding, considerable progress has been made in developing various kinds of equipment, to make its use more easy and general. But the real science

Test of Trusses Made for Building Department, New York City.

of electric arc welding lies in the human skill behind the equipment.

Electric arc welding owes considerable of its advncement, as a science, to the laboratory work which has been done by the engineering staff of the Electric Welding Company of America. These engineers have kept everlastingly at it, perfecting known methods and devising new methods of application, and have successfully demonstrated in many ways that the electric arc welding process is commercially practicable.

One of the noteworthy achievements of the engineering staff of the Electric Welding Company of America has been the

Bracket for 5-ton Crane Joined to Column by Electric Arc Welding.

recent demonstration of the practical application of electric arc welding to steel construction work.

The Electric Welding Company of America needed a new building as an addition to its plant in Brooklyn, and needed the building in a hurry. The engineers were absolutely confident that such a building could be constructed by welding instead of riveting, and that there were specific advantages which would result from such a method of construction.

In the *first* place, the construction work could be done during twenty-four hours of the day without disturbing the people in either commercial or private life, because the process is absolutely silent, the nerve-raving noise of riveting being entirely eliminated.

Second—The necessity of fabricating steel parts was almost entirely eliminated, and likewise the necessity of waiting several

Base Plate Joined to Column by Electric Arc Welding.

weeks until such parts should be fabricated and made ready for erection. *Third*—By electric welding joints of 100 per cent strength were made possible, as against the ordinary sixty or seventy per cent strength possessed by a riveted joint. *Fourth*—There was possible a reduction in the actual weight of metal required in the various members, and *Fifth*—Actual tests had conclusively demonstrated that construction work by electric arc welding could be done at lower cost than by riveting.

Before the Electric Welding Company of America could proceed with its building plans, it was necessary to obtain permission from the various city building departments, and such permission would only be given if certain tests were made which would satisfy the building officials that a welded structure would be absolutely safe and would compare favorably in all other respects with a riveted steel framework. Certain samples of welded joints were requested for tests as to strain, compressing and shearing.

Peak of Truss Showing Members Joined by Electric Arc Welding.

A specific sample of a lap weld 1¼x⅜-inch bars and ends

*Supervising Engineer, Electric Welding Company of America.

ROEBLING WELDING WIRE

(At Left)—Cast Iron Bed Plate from Browning Hoist, 15 tons capacity. Broken in several places. After 24 hours of welding, depositing 76 lbs. of Roebling 5/32 in. diam. Electrodes. Total cost of repairs, $35.80. A new casting would have cost $1,300.

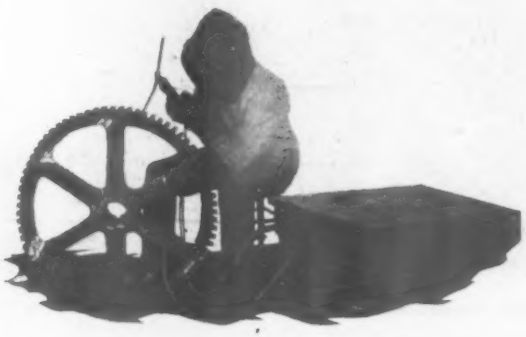
(At Right)—Cast Iron Ladle. 7 tons. Crack, 16 ft. ½ in. wide, metal 3 in. to 4 in. thick. Repaired in 36 hours with 400 lbs. of Roebling Gas Welding Wire.

ROEBLING ELECTRODES

ROEBLING GAS WELDING WIRE

JOHN A. ROEBLING'S SONS COMPANY

Trenton, New Jersey



Bulletin 104

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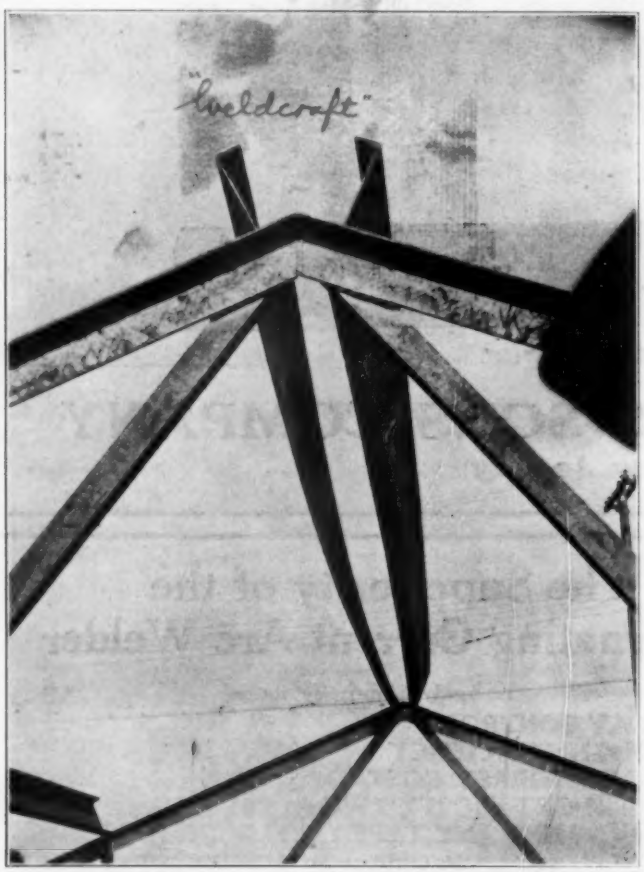
CHICAGO, ILL.

lapped 1¼ inches and welded across the edges, was submitted. This welded sample was put in the machine in direct tension and developed the full strength of the bar as the break occurred in the bar 3 inches above the weld and developed a strength close to 60,000 lbs. per square inch without effecting the weld. These welds were cut across but showed no line of markation between the welding metal and the original bar metal.

Another sample consisted of two angles set at right angles and lap welded at the intersection, the 3-inch legs vertical (2x3x⅜ inch). This sample was set in a machine so that there was a horizontal lever arm of 8 inches from the center of pressure to the center of weld and intersection, and developed a beam load of 11,375 lbs. at the weld or a torsional stress of 91,000 lbs. at the weld with no apparent distress to the weld.



Purlins Joined to Trusses by Electric Arc Welding.

The angles buckled to such an extent that they failed to resist pressure.

The tests of these samples were entirely satisfactory to the building officials. Permission was subsequently given to proceed with the erection of the steel framework, but there was still another test to be made of the steel trusses of forty feet span, which were to be used to sustain the roof. These trusses were of fan type of design and all members were electrically welded together, no bolts or rivets being used. The trusses were spaced twenty feet apart, supported by 8x8 H beam columns 19 feet high; on the sides of these columns, brackets were fastened to carry an overhead traveling crane of five ton capacity. The weight of each truss was about 1,400 lbs., the top and bottom chords were composed of 4x5x⅜ tee irons, and the struts were 3x2x⅜-inch angles, the purlins were 10-inch, 15-lb. channels.

The trusses were designed for a live load of 40-lb. per square foot, each truss supporting a panel of 800 square feet. They were tested at a load of 120 lbs. to the square foot, or a total load of 48 tons on the two trusses. The load consisted of gravel in bags which were piled in tiers on planking arranged for the purpose.

Readings were taken at different increments of the loadings for the deflection in the truss or members.

The trusses were left under load 48 hours and reading taken showed—East support settled 15/16 inch, West support ¾ inch actual; point No. 2, 7/16 inch actual; point No. 4, ½ lb. actual deflection; point No. 3, 9/16 inch actual deflection. Two days afterward the load was entirely removed and readings taken at this time showed all points in the trusses had returned to their original position, leaving no permanent deflection except at point No. 3 of 1/16 inch.

To quote from the official report: "From the above it is evident that electric welding is a dependable method of unit-

Bracket Constructed and Joined to Column by Electric Arc Welding.

ing structural members and is stiffer than riveting if the work is properly performed."

It is particularly interesting to note that this test was actually carried to the limit of elasticity of the metal used. There is no doubt that this successful demonstration which was made by the Electric Welding Company of America will do much to further the use of electric welding in steel construction work. The many specific advantages are too important to be disregarded by engineers and contractors, particularly in these days when there is a vital demand for increased housing facilities for homes as well as for industries. It would seem almost axiomatic to say that electric arc welding is going to make substantial progress in displacing riveting in the structural steel field.

The mere fact that this test was witnessed by members of all the building departments in Greater New York, and as a result, a permit was issued for the erection of the building, the first of its kind for the Electric Welding Company of America, should be sufficiently convincing to the skeptical, that electric

Superior Brazing Compound

A product of years of time and study. Over 98 per cent pure boron. Its use is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

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Cheaper than any other compressed gas

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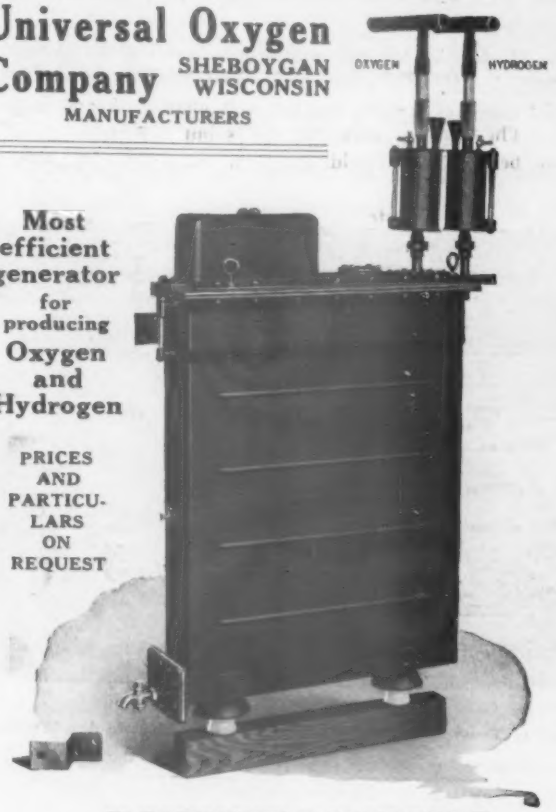

Most efficient generator for producing Oxygen and Hydrogen

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That is Aluminum Solder Applied with a Soldering Iron

We wish to present an ALUMINUM SOLDER that is entirely new to the welding fraternity.
Any man who knows the first thing about using a soldering iron can complete a far superior aluminum weld with our Aluminum Solder than the most experienced aluminum welder in the country under the old method.
Aluminum welding has always been a very difficult operation, and one that required the highest experience known in the business, but today by the aid of our famous WELDIT Aluminum Solder a novice or tinner can make an aluminum job far superior to anything ever attempted heretofore. There is no long drawn out set of instructions to go with this solder. All that we ask is that you warm up the casting pretty well with the torch, then clean the Aluminum crank case or sheet thoroughly and rub the solder into the broken part with a large size soldering iron, very hot. It is practically impossible to break the joint and will hold far better than the average aluminum weld. It is generally the simple mechanical operations that are the best, and this is unquestionably a specific case.
Do not fail to send for a trial pound of this material. No samples furnished free. We will not ship C. O. D. We guarantee this to be superior to anything ever shown, or your money will be refunded upon receipt of returned solder.

Price $2.50 per pound

WELDIT ACETYLENE CO.
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Manufacturers of

SEAMLESS STEEL CYLINDERS

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welding as a means of construction, is not an unknown quantity but is a certainty.

The Electric Welding Company of America has been receiving inquiries from a great many prominent engineers and industrial companies since this test was conducted, and is preparing to go into the construction field very definitely.

Generally speaking, electric welding can be used in all parts

Heel of Truss Showing Members Joined by Electric Arc Welding.

of steel structures—but the following specific list shows its direct application in the construction of:

Columns—plate and angle.
Columns—channel and plate.
Columns—latticed.
Flooring—corrugated and Z bar.
Trusses.

and for joining

Bearing plate to upper and lower ends of columns.
Trusses to bearing plate and columns.
Gross bracing between columns.
Purlins to roof trusses.
Wind bracing supports.
I beam rail for trolley supports to columns.

These are just a few of a long list of instances where electric welding eliminates the use of bolts, rivets and gusset plates and in some cases connection angles and brackets.

There is a distinct saving in both material and labor cost where electric welding is used. The following table published by W. T. Bonner in Marine Engineering shows the relative cost of riveting and welding in construction sections of steel barges.

TABLE I. ESTIMATED CONSTRUCTION COST OF 166-Ft. by 39-Ft. by 8-Ft. 8-In. Barge.

Based on 1917 wage rates and material prices.

	Items	Riveted Design **	Welded Type
A	Plate Fitters	$1,236.00	$ 618.00
B	Punching and Shearing	1,045.00	322.00
C	Countersinking and Reaming	976.00	0.00
D	Riveting	3,427.00	0.00
E	Chipping and Calking	523.00	265.00
F	Smithwork	557.00	275.00
G	Erection and Assembling	2,010.00	1,320.00
H	Electric Power	382.00*	95.00*
I	Foreman	360.00	360.00
J	Plant-Special Equipment	0.00	300.00
K	Superintendence	0.00	900.00
L	Rivets	780.00	0.00
M	Liners	142.00	0.00
N	Shed and Shoring, Lumber	0.00	145.00
O	Electric Welding—Including "Tacking" 51,300 feet Single Fillet— Welders—6,000 hours at 60c	$3,600.00	
	Current—6,000×5—30,000 K. W. H. at 2½c	750.00	
	Wire 7,200 lbs. at 6½c	450.00	
		$4,800.00	0.00 4,800.00
P	Incidentals and Profit		0.00 1,838.00
Q	Total		$11,438.00 $11,438.00

TABLE II. COMPARATIVE DETAILS OF RIVETED AND RIVETLESS SHIP STRUCTURES DEVELOPED BY MEASUREMENTS OF ACTUAL BILGE SECTIONS

(Illustrated by Appended Photographs).

	Items	Riveted Design **	Welded Type
A	Weight of Plates Required	2,488 lbs.	1,884 lbs.
B	Weight of Angles, Beams and Channels	764 lbs.	194 lbs.
C	Weight of Straight Bars	None	360 lbs.
D	Number of ⅝-in. Rivets	48	None
E	Number of ¾-in. Rivets	231	None
F	Number of ⅞-in. Rivets	108	None
G	Total Number of Rivets	337	None
H	Total Weight of Rivets	200	None
I	Number of Liners Required	4	None
J	Weight of Liners	31 lbs.	None
K	Weight of Weld Material Added	None	120 lbs.
L	Total Weight of Complete Section	3,483 lbs.	2,358 lbs.
M	Lineal Feet of Heavy Flanging and Shaping	22	None
N	Square Feet of Forge Shaped Bilge Plate	24	None
O	Square Feet of Machine Rolled Bilge Plate	None	20
P	Number Lineal Feet of Welds in terms of ¼ square inch section	None	620
Q	Number Lineal Feet of Calked Edges	57	None
R	Total Number of all Rivet Holes in Section	826	None
S	Average Area of Plates of full size	17,280 Sq. In.	15,235 Sq. In.
T	Average Area of Rivet Holes in same	431.97	None
U	Average Number of Rivet Holes in same	550	None
V	Reduction of Plate Areas Due to Punching	2½%	None
W	Typical Number of Holes in Rows Across Plate	15	None
X	Average Total Diameter of Rows Across Plate	15%	None
Y	Average Proportion of Hole Diameter to Plate	25%	None

**Current used for lighting, punching, shearing and air compressors only. Current for welding covered in Note "O."*

***All figures for riveted design based on actual book cost of three barges completed during preceding month.*

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We are headquarters for Welding, Cutting, Carbon Burning and Lead Burning Equipment and Supplies of all kinds and ship on short notice. Write for the Imperial Catalog and full, detailed information regarding methods of operation, economies effected, etc.

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Large rope drive pulley broken in seven pieces. Welded with Imperial Equipment.

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RED SEAL CAST IRON FLUX	Per lb.
1 to 5 lbs.	$0.50
5 to 10 lbs.	.45
10 to 25 lbs.	.42
25 to 50 lbs.	.40
50 to 100 lbs.	.37
100 lbs. or over	.35

Prices on FLUXES for other metals furnished upon application.

Cast Iron Rods, Welding Wire for Steel, Aluminum Rods, Tobin Bronze.

Write for Jobber's prices.

Memphis Welding Co.

MEMPHIS, TENN.

WELDING PINCER

MODEL 3

Price, $1.00—3 for $2.50

Length, 16 inches. Weight, ½ pound. Holds the welding rod rigid at angle shown.

U. S. A. Patent No. 1301185, April 22nd, 1919. Foreign Patents Pending.

A slight pressure on small lever opens jaws.

SENT TO ANY WELDING SHOP FOR A 30 DAYS' TRIAL ON RECEIPT OF PRICE.
If not needed after that, return pincers and money will be refunded promptly.

Jobbers and Agents, write **C. SORENSEN, 18 E. 16th St., CHICAGO**

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

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III. Shop Equipment.
IV. Apparatus repairs.
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Part Two—Welding of Cast Iron.
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XI. Oxy-Acetylene Cutting.
XII. Carbon Burning.
Glossary.
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NOTE:

1. This includes no allowance for bilge keel.

2. All plates are calculated as of same thickness for both types.

3. Difference in weights given in item "A" due to butting plate edges for welding instead of using lapped seams for riveting.

The difference in cost should be of extreme interest to the land engineers and contractors.

The fact that the engineers of The Electric Welding Company of America have brought to a successful conclusion, their efforts to demonstrate to the public in general, that electric welding could be used on a larger scale than ever dreamed of before, is particularly satisfying. They are now designing some special trusses which are to be constructed by electric welding for one of the Government Departments. The experience which they have had in overcoming certain difficult features by designing section and joints of a special type, places the Company in a very advantageous position to render very valuable assistance to the engineer, the contractor or to the owner of a plant who is contemplating additional plant facilities.

THE BROTHERHOOD OF WELDERS

The Brotherhood of Gas & Electric Welders and Operators of America, Grand Lodge, incorporated 1918 under the laws of Virginia, located at Newport News, Va., is now actively engaged in instituting local lodges in all principal cities in the United States, and has recently issued a charter to Chicago Local Lodge No. 301. This BROTHERHOOD is founded on somewhat different lines and principles than the ordinary union organizations as they accept to full active membership not only welders in both gas and electric who are employes, but also employers who actually handle the torch and work with their employes at the art. It is also the purpose and hope of this Brotherhood to work in HARMONY with the manufacturers and employers by furnishing them with better welders, and thereby prove to their employers that an EXPERT craftsman is worthy of more consideration and a better wage than an amateur or apprentice. Members of this Brotherhood will be classified as welders who are real welders, apprentices, and helpers, and it is the earnest desire and hope that each classification will be able to prove to their employers that they are entitled to a wage based on their experience and proficiency in the art. Up to the present time there has been no particular scale of wages, and there has in consequence been much dissatisfaction, both among the employers and employees, and it is the desire and intention of this organization by a united and earnest effort to supply the market with not only real experts in this line of work but gentlemen who really believe in a fair and square day's labor for a fair and square day's wage. This organization will have more to say on this subject from time to time, and we welcome to membership all welders in the State of Illinois, who consider themselves GENTLEMEN of their word and honor, and are willing to abide by the constitution and by-laws of this order.

Respectfully and fraternally,

The Brotherhood of Gas & Electric Welders and Operators of America, Chicago Local Lodge No. 301.

By Charles H. Knight, Illinois State Organizer,

521 W. Jackson Blvd., Chicago, Ill.

FRENCH OPINION OF AMERICAN APPARATUS*

Under the title of "The Oxy-Acetylene Industry in France," we published three months ago the principal passages from the article which appeared in *The Welding Engineer*, under the signatures of Major Paul Pleiss and Lieut. C. V. Price, who had the leisure to study our apparatus and our methods in the course of their sojourn in France, during the second half of the war.

We had ourselves made some reservations on certain appreciations of the authors.

Mr. Paul Dumesnil, vice-president of the Syndical Chamber of Autogenous Welding, has written to us, with regard to the publication of this article, the following letter, which moreover represents about the same opinion that several technical men have expressed to us on this subject:

"To the Director of the Revue de la Soudure Autogène:

"Dear Sir:

"I have carefully read the leading article in the last number of your Revue, where you summarize substantially a study which appeared recently in an American paper.

"Excuse the expression, but in this work there seems to me to be something 'to eat and to drink.' I neither intend to drink anything nor to eat anyone, but nevertheless, I would like to put the dots on certain i's which seem to me to have been somewhat neglected, especially in the part entitled by the authors: 'Practice of Autogenous Welding.'

"In a word, what results from the American article is first of all a pro domo plea, with a succession of affirmations destined to convince the reader that with our American friends everything is better there than elsewhere in the matter of autogenous welding, processes, apparatus, works, etc. * * * with, however—we must be impartial—an exclamation point for our laboratory technique.

"But, no, really, all those who have come to know the autogenous welding apparatus used in America will tell you, as I do, that everything is not as perfect as the authors of the article wish to tell us; the American blow pipe particularly—moreover this is what I know best regarding the question—are far from equalling those utilized by us and in addition, is our beautiful France not the cradle of autogenous welding and of all the industries connected with it, liquid air, dissolved acetylene, etc., etc.?

"Are the powerful American companies not generally content to utilize and to apply as concessionnaries patents which originated in France, which were developed there, and to which the inventors are still bringing every day improvements and perfections? Certainly the proverb which says that no one is a prophet in his own country, is especially true in France; it is probably very false in America, but beliefs such as those which are developed in the American article should not be accredited with us with impunity, for example this—I quote integrally: 'The superiority of the American apparatus is quite visible.'

"I do not wish to mention any inventor's name nor any make of our apparatus for fear of forgetting too many of them among the best, but what I wish to say is that American engineers of great renown have recognized on the contrary, and quite recently, that a number of their autogenous welding apparatus were quite inferior to ours.

"Perhaps some day you will have the opportunity to make a comparative and careful study and comparison of the processes of the American apparatus on the one hand and ours on the other hand. I sincerely hope so, for as I have known for a long time the care and impartiality with which you make studies of this kind. I know in advance the conclusions which you will reach."

*From the March issue of Revue de la Soudure Autogène (Paris).

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and cracked water jackets successfully repaired. Our factory nearest you will make these repairs on a 24-hour service basis.

Regrinding of cylinders that have been scored by wrist pins or through other causes is unnecessary. The Lawrence Patent Process fuses a silver-nickel alloy into the defects,

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San Francisco—116 Hyde St.

LICENSEES

Boston, Mass.—Back Bay Welding Co., 6 St. Mary St., Back Bay.
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Des Moines, Iowa—Bernhard & Turner Auto Co., 506 W. 7th St.
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Eustis, Fla.—M. Hopson.
Evansville, Ind.—The Lindenschmidt Co., Ingle St. between 1st and 2nd Aves.
Flandreau, S. D.—Amdahl Bros. Co.
Fort Wayne, Ind.—Motor Truck Sales Co.
Grand Rapids, Mich.—Ox Welding Co., 75 Sheldon Ave.
Galesburg, Ill.—Galesburg Machine Works.
Hartford, Wis.—Kissel Motor Car Co.
Harrisburg, Pa.—Harrisburg Welding & Brazing Co., 94 S. Cameron St.
Hartford, Conn.—Charter Oak Machine Co., 438 Asylum St.
Jacksonville, Fla.—Wm. Mock, Jr., 41 E. State St.
Kansas City, Mo.—General Auto Parts Co., 1621 Grand Ave.
Louisville, Ky.—Southern Motor Co., 615 S. 3rd St.
Lima, Ohio—Buckeye Welding & Repair Shop, 133 Water St.
Lincoln, Nebr.—Lincoln Motor Car Co., Cor. Q and 12th Sts.
Montrose, Colo.—Hartman Bros. Co.
Memphis, Tenn.—J. B. Cook Auto & Machine Co., 247 Poplar St.
Marion, Ohio—R. G. Wolfel Welding Co., 206 W. Church St.
New York City—Goodwin Welding Co., Inc.
New Haven, Conn.—New Haven Welding Co., 763 State St.
New Orleans, La.—Scored Cylinder Repair Works, 724 Julia St.
Portland, Me.—Portland Garage Co., 49 Cross St.
Pensacola, Fla.—East Hill Garage, 1501 E. Blunnt St.
Portland, Oregon—M. Otzen, 16th and Glisan Sts.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
Reno, Nev.—Central Auto & Machine Works, corner 5th and Sierra Sts.
Rochester, N. Y.—General Welding Works, 87 Cortland St.
Raleigh, N. C.—Republic Service Co., 108 S. Blount St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 Jefferson Ave., N.
Saginaw, Mich.—J. & M. Welding & Repair Co.
Salt Lake City, Utah—Karl Winter, 719 S. State St.
San Antonio, Texas—General Welding Co., 105 Villita St.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Springfield, Ill.—Romie Fields, Rear 317 S. 3rd St.
Seattle, Wash.—Motor Parts Co., Inc., 815 E. Pike St.
Sawyer, Wis.—F. J. Pies & Co.
Sioux Falls, S. D.—Schmidt & Son, 319 N. Main St.
Sioux Falls, Iowa—W. A. Carlson, 1110 Fifth St.
Scranton, Pa.—Scranton Welding Co., 321 Washington Ave.
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Tampa, Fla.—R. G. Wood, 113 Water St.
Utica, N. Y.—Sherman Sales Co., Inc., 516 John St.
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The Economy Welding Machine Company, Kansas City, Mo., report a rapidly growing business and it is now planned to double production in 1920. It is an interesting fact that one of the first Economy torches manufactured in 1910 in a little 12 by 24 foot shop where manufacturing was first started, is still in use in the shops of the company at Kansas City. It is an admitted fact that it is unusual for a welding torch to remain in constant operation over a period of ten years.

The Boston sales office of the Davis-Bournonville Company has been removed from 125 Pearl Street to 44 Federal Street. Mr. Geo. J. Strobel is the manager.

The Board of Directors of the Gas Products Association held their regular monthly meeting at the Association headquarters, Chicago, on April 23rd.

THERMIT WELDING

The Metal & Thermit Corporation, New York, N. Y., has issued a third and revised edition of its pamphlet entitled "Laboratory Experiments with the Thermit Process of Welding." This pamphlet is useful as a guide for acquainting students with the substance, characteristics and results of the thermit reaction. The pamphlet illustrates and describes various experiments which are intended to show the speed of the reaction, the most produced thereby and the effects obtained by the superheated liquid slag and the superheated liquid steel.

The interests of the firm of Eble & Diehl, 335 North Indiana Ave., Atlantic City, New Jersey, have been acquired by J. B. Diehl. Mr. Diehl, who has contributed to the columns of *The Welding Engineer* in the past, is a welding specialist.

The Acetylene Light and Agency Company, Ltd., Honolulu, T. H., has secured the exclusive agency for D-B apparatus in Hawaii.

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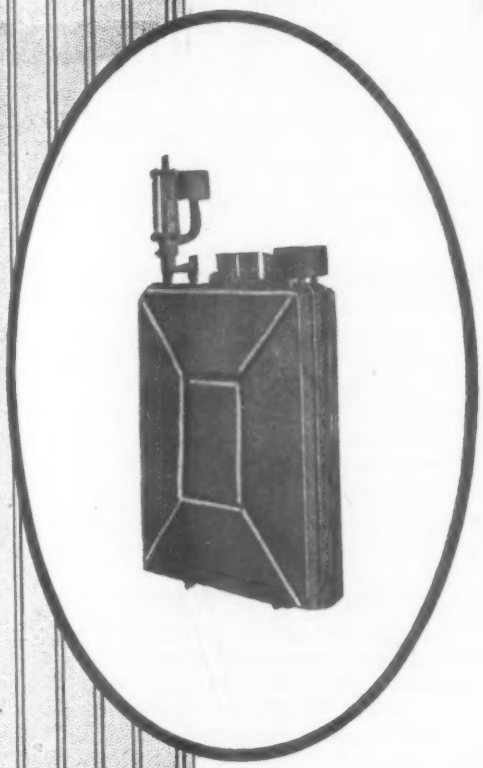

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ADVICE FOR WELDERS

By G. F. King*

Much has been written in these columns pertaining to details of handling welding jobs, from the old stove leg to a locomotive boiler, but little discussion as to how said job got to the welding shop in the first place. To the countless number of small shops throughout the country, who are struggling to get their welding service across to the public, this article is particularly directed, as it will give one man's experience in bumping up against the public with a welding machine and a handful of small tools, and in a community where welding was yet suffering with a nice black eye.

In 1915, after spending something like eighteen months as a helper in one of the larger welding shops in the West, I decided to start a little old welding shop of my own. Coming East and looking the different possible locations over carefully, I picked out a county seat town of 10,000 population, 27 factories and surrounded by a rich farming country, and opened said shop (if it could be called a shop), in an old barn in an alley.

All my friends felt sorry for me and said, "Boy, you'll starve to death with that new-fangled contraption of yours; some have tried it before, and also ran."

Came one bright morning, when, taking my belt up to the last notch, I set out to land myself some nice welding business. Meeting one Mr. Factory Superintendent and explaining the object of my visit, was told very polite like, that the system was no good. Yes, they had tried it once, and to their sorrow. When they got their stuff back it was so burned up, twisted and warped, so hard it could not be machined, in fact, from his version of it, everything happened to it that could possibly happen to iron, and he wound up by again stating that the system was no good, absolutely no good. I knew better, and what I heard just then made me peeved, and I promised myself a job from him, if it had to be taken with force. I asked him if one of his machinists would spoil a piece of work in a lathe or planer, if he would declare the system no good and chuck' em out the back door? Oh, no, nothing like that, but with welding it's different, he comes back. Well, if it's different with welding, why don't you try a different welder? I asked. Didn't think of that, he states. If you can do any better, we would like to see what a good welding job looks like; never saw one. I was then ushered to a fat scrap pile, and he showed me a number of lathe carriages, spoiled by having a boss drilled and tapped the wrong size. Could I "run a little iron in those holes so they could be drilled and tapped again?" No, but I replied, I could knock the old boss off and build on a new one. Don't want it done that way, he says. Why can't you just run a little iron in there and fill the hole up? Can't be done that way, I replied, and explained that the new iron could not be fused in the bottom of a ⅜-inch hole one inch deep. Don't have to be fused, he stormed, just run a little iron in 'em and fill 'em up. If you want to do work for us, you will have to do it the way we want it done. Yes, I said if you want to pay for something that is of no use to you, I will take some of these pieces and weld them and absolutely guarantee that you can't use them after I "just run a little iron in 'em." Well, take 'em and see what you can do with them, he said, anxious to get rid of me.

With one lathe carriage under each arm I returned to the shop and after carefully heating them, built up a nice lug on each one, cooled slowly and made sure no hard spots were present in the welds, and once more returned to factory with the finished article. They were waiting for me, and I sauntered right up to Mr. Superintendent and told him to say what fault he could find with them. He was anxious himself by this time, and immediately gave them to the drill press operator to re-drill and tap.

Some onlookers about the shop had gathered around with the expectation of seeing a perfectly good drill and tap ruined against a hard weld, but when the drill went right through like through any other iron and was easily tapped they began to sit up and take notice, and they have been sitting up and taking notice ever since, and not only have truck loads of welding done, but are one of the best boosters for welding there is.

It has always been the belief of the writer, that there are too many small welding shops that are being kept down by letting the public do their thinking for them in regards to details of just how the work should be done. Very little work this shop gets that is not accompanied with instructions as to how it is to be done. We always agree with them, and after they go out, do the work the way experience has taught to be the best. That saves useless argument and makes everybody feel good.

Another fault found in most all small shops is letting the customer spend his idle time hanging over the table where the welder is working, asking questions, offering suggestions, getting tangled up in the hose and being a nuisance to the workman in general. No welder can do his best when all this is going on to distract his attention from the work in hand. If, through the customer's interference with a welding job, it falls down, and comes back to you, does the customer say it was his fault? He should not have made you do it his way. Not so you could notice it. He throws it down and says you did a rotten job for me; fix it so it will hold this time will you? And that is what you have done. A rotten job was his fault in the first place, and the welder's fault in the second place, and in the third place you are the man that pays the bills, so why let George tell you how to do it.

*Sidney Welding Works, Sidney, Ohio.

NEW FRENCH BOOK

A new and valuable addition to the literature of autogenous welding has been published in France by R. Granjon, P. Rosemberg and M. Piette, entitled, "Elements of Autogenous Welding'.' The book consists of a set of Questions and Answers, constituting the A. B. C. of the technical and practical knowledge on the subject.

In the preface of the new book Mr. R. Granjon, one of the authors, says:

"The 'Practical Manual of Autogenous Welding' responded to the demand of industrialists, engineers, foremen, and laborers who, having to apply the process, desire to obtain all the technical and practical information in order to derive a benefit from it rapidly and profitably. We believe that its successive editions have rendered some service to the thirty or forty thousand readers who wished to make use of the information which we tried to give them in a complete and precise fashion regarding everything connected with autogenous welding.

But, since the work undertaken for war needs has made autogenous welding universally known and has definitely consecrated it, each one, from the pupil of our professional schools to the old blacksmith whose art and skill were acquired only after long years, wishes to know the elementary things about the new process which will be applied tomorrow in all the shops, beside the most modern machine.

We thought that before the "Practical Manual of Autogenous Welding", the brilliant career of which has increased each year as the corresponding edition is published and completed there should now be placed a work if not more ele-

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ELECTRIC WELDING

By ERIK OBERG

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Electric welding has become so important an art in the mechanical industries that a comprehensive treatise on this subject covering both the resistance and the arc welding processes is needed in the trade. A special study of the subject has, therefore, been made by the authors of this work, who have been assisted in their work by the experts in resistance and arc welding of some of the most prominent concerns in the United States engaged in this line of work.

Consultations with the experts of these companies have made it possible to obtain thoroughly up-to-date information embodying the latest developments and discoveries in the art, and it is believed that, for this reason, the book will prove especially useful to those who are already employing electric welding equipment or who are contemplating its use, as well as to the students of the subject who desire to obtain authoritative information on the electric welding processes.

CONTENTS

Electric Welding Processes—Electric Resistance Butt-Welding Special Butt-Welding Machines and Processes—Electric Spot-Welding—Seam-Welding and Riveting—Percussion Welding—Electric Soldering—Principles of Electric Arc Welding—Applications of Electric Arc Welding—Welding Transformer Tanks by Electric Arc.

"Electric Welding" is splendidly bound in green cloth. It is fully illustrated with cuts and engravings and gives in its 295 pages exactly the data and information on electric welding that the man in the machine building plant requires.

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mentary, at least more concrete in the indispensable elements of the subject.

RATIONAL USE OF THE CUTTING BLOW PIPE*

By Marcel Piette

The technique of welding is better known than the use of the cutting blow pipe, and if this last named is often found in welding stations with the welding blow pipe, it is surely more often put to a worse use.

It can be asserted that the bad results obtained in the cutting of iron and steel come because the cutting blow pipe is an instrument the exact regulating control of which is delicate.

If it is true that if in the use of the welding blow pipe it is always possible to know at first sight the regulating of the flame and the aspect of the fusion bath, it is also true that very good practitioners of welding do not know sufficiently the practice of cutting.

A well-regulated cutting blow pipe for a certain kind of work, is that in which the oxygen pressure, the exhaust aperture of the cutting jet and the heating flame, are in proportion to the thickness of the piece to be cut.

We could cite many examples in which cutting with a blow pipe shows an enormous waste of oxygen, and very poor work. One of the most striking and the very latest one which we have been able to witness is the following: In a shop near Paris, a firm was demolishing a large quantity of car frames which the Germans had set on fire in a northern station, during their retreat. The frames were delivered by pieces easily transportable to be used for some other purpose. The work consisted, in fact, to cut with the cutting blow pipe some U-shaped beams and flat iron pieces, the thickness of which ranged from 20 to 25 mm, as the larger pieces were left intact with the frames.

The blow pipes employed for this work were of the oxy-acetylenic type with central jet, fed with acetylene by movable generators of the contact type. We are not exaggerating when we state that eight times less oxygen could have been used for this work if the operators had had in their possession the necessary elements allowing them to appreciate a good execution of their work. The cutting operation was done in the following manner: The blow pipe after being lit, the oxygen used for cutting escaped without the flame having been regulated which during the whole operation showed an excess of acetylene; then the operator, forming the fusion of a part of the iron to be cut, was swinging afterwards the blow pipe from left to right of the sectioning line obtaining thus a fusion of the metal, increased by the oxygen. This operation, being from this fact, very slow, gave a cut from edge to edge large enough to allow the thickness of the hand to pass through!

If we add to that that the aperture of the cutting nozzle had been chosen without discernment, too strong, and that a six-kilos pressure was in current use, without mentioning the many leaks at the fittings and joints of the manometers and blow pipes, one can imagine the great saving which could have been realized in such a shop if it had been equipped with four or five cutting stations during several weeks.

It seems to us that it is necessary to recall the principal conditions and the rational and economical use of the cutting blow pipe.

The first thing most commonly found is the too frequent and almost general use of a too high oxygen pressure. One finds too often also inexperienced workmen who compare cutting to a physical phenomenon and attach much importance to the "force of the jet." One on the contrary must be impressed with the fact that the cutting of iron and steel is only a destruction of the metal through a chemical phenomenon, the oxygen pressure helping only to bring the gaseous stream over the whole thickness to be cut.

An operator who is not well experienced in oxygen pressure to be used, is naturally tempted to employ high pressure, for the manufacturers of valves deliver to their customers, especially for cutting purposes, apparatus equipped with manometers graduated up to 25 and 30 kilos.

In comparison with the graduations which are made for the valves for welding purposes, the operator is tempted to use, through simple deduction, pressures from 5 to 6 kilos for cuts not any thicker than from 10 to 20 mm, and from 10 to 15 kilos for work for which a pressure half as high would be sufficient.

Is the result better and the cutting done quicker?

It is certain that a slight increase of oxygen pressure may give a quicker cutting, but the expense in gas is also increased. There is, thus, no real economy by using a higher pressure.

By way of compensation, experience shows that the use of oxygen at exaggerated pressure rather slackens the speed in cutting, through the cooling off caused by the expansion of unused gas and of the air forming around the jet. Thus, one must be very careful to use just the pressure necessary for a normal outlet of the cutting jet. These pressures can be settled very approximately as follows, when sheet iron and ordinary iron for construction purposes and under normal conditions, are concerned:

Thickness In Mm.	Pressures In Kilos
Up to 12 mm	1 to 1.500
From 12 to 30 mm	1.500 to 2
From 30 to 50 mm	1.700 to 2.500
From 50 to 100 mm	2.250 to 3.500

It is to be observed that the oxygen pressures for cutting leave a certain margin for their use on different thickness. Thus these pressures in certain proportions, are the function of the aperture of the cutting nozzle.

Cuts of the same value may be obtained, for example, by using a pressure of 1 kilo 500 with a cutting nozzle of 10/10th and a pressure of 1 kilo with 12/10th; the table below shows the diameter of nozzles which can be practically used.

For cutting blow pipes with separate jets one can easily go as low as 10 mm, especially if the separate feeding of heating oxygen and cutting oxygen is realized. In the most current case in which the blow pipe is only fed by one stream of oxygen and especially in central jet type more subject to back flame through obstruction of the nozzle, the pressure of 1 kilo 500 is practically necessary to obtain a good heating flame.

Another important cause to figure out the cost of the work is the section allowed for the flowing of the cutting oxygen. One must remember that the sections of circular apertures are in themselves like the quadrate of their diameters and that theorically a cutting nozzle of 20/10th, must give way to four times more oxygen than a nozzle of 10/10th under the same pressure conditions, supposing that the waste of gas are equal in both cases, which is not absolutely exact. It is easily seen thus, that the more mistake of choosing a cutting nozzle of 2 mm instead of 1 mm will immediately give a quadruple expense of oxygen. It would be already doubled in the case of using a nozzle having an aperture of 15/10th instead of 10/10th.

In the work shops, the thickness to be cut are generally from 8 to 30 or 40 mm, when sheet iron, iron of large plates

*From the March (1920) issue of Revue de la Soudure Autogène (Paris).

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are concerned, and up to 80 to 100 mm, for bar sections, profiles or round pieces.

This table gives the diameters of the nozzles:

Thickness In Mm.	Apertures Of Nozzles.
Eight and below	7/10th
From 8 to 20	10 to 12/10th
From 20 to 40	12 to 15/10th
From 40 to 75	15 to 17/10th
From 75 to 125	15 to 20/10th

For cuts on thickness below 15 mm, there exists smaller types of cutting blow pipe with central jet, having series of nozzles the apertures of which are very small and begin from 6/10th for sheet iron to 5 mm.

We also call the attention of the reader to the importance of the puriness of the oxygen in the cutting mechanism. There is also in this case chances of saving in the shops, if the puriness of the gas is controlled and if nothing but the purest of gas is used in the cutting stations.

The effect of impure oxygen is the slackening of speed in the cutting and this is so clearly noticeable that it must attract the attention of the practitioners.

As per the experiments of the Laboratory of the Old Union of Welding (Union de la Soudure Autogène), the speed in cutting, under equal conditions, is reduced to 30 per cent for a quantity of azote of 6 per cent for a speed obtained with oxygen at 99 per cent. At 91.5 per cent, this speed is reduced to 50 per cent!

The influence of the puriness of oxygen is well known by heavy thickness specialists who know that below 95 or 96 per cent of the puriness of oxygen they cannot make a cut.

Besides, the use of impure oxygen is one of the causes which often oblige the practitioner to use a higher cutting pressure, leading to an enormous waste of gas without appreciable improvement.

The power of the heating flame must itself be in proportion to the thickness to be cut. If it is too weak, it slackens the speed in cutting and favors the loss of the oxidation point; if too strong, it provokes the fusion of the superior parts.

A thing which is not observed enough in the cutting done in shops, is the space which must exist between the sheet and the nozzle. This space must be the smallest possible, so that the oxygen jet coming from the nozzle, produces a narrow cut. Any exaggerated space between the nozzle and the sheet tends to increase the width of the cut on account of the divergence of the gaseous stream which is produced when coming out of the apparatus. This divergence is attenuated by an inside profile in the cutting nozzle especially studied for that purpose.

The oxy-acetylinic and oxhydric blow pipes with separate jets permitting to get closer to the sheet iron than the central jet blow pipes, the heating flame of which, though very short, leads to a certain separation of the nozzle from the surface to be cut. The construction of this kind of blow pipe forces one to place on a same level the extremities of the heating nozzle and of the cutting nozzle.

An improvement on the results of the cutting blow pipes is obtained by previously heating the cutting oxygen. Many work shops where extensive cutting is done would reduce their expenses if they would adapt to their blow pipes or on one of the cutting oxygen pipes, a device of some kind, properly studied, allowing to increase the temperature of the combustible gas.

This suggestion is the result of trials made at the laboratory of the Old Welding Union, a few years before the war, and that we intend to resume for the finding of devices suitable for the industry.

It seems thus, that an improvement on cutting blow pipes could be obtained, and this simply by the strict application of the most elementary principles of technic and practice on this subject. Great saving could be made in shops where cutting is done without care, precisely in those places where cutting with the blow pipe is considered as too expensive.

The cutting blow pipe is really a marvelous instrument which can be used with advantage and economy, not only for tearing down or ordinary cutting of steel parts, but also in new undertakings and many very interesting cases in metallic construction.

On this subject the Americans have gone ahead of us and they have created special implements and tools which allow them, with an excellent technic and practical use, to perform all sorts of cuts and on all thickness, just as fine as if they were made with mechanical tools, much quicker and much more economical.

ELECTRIC ARC VERSUS GAS WELDS

In the April 15th issue of *Power* a letter is published from a New York engineer in which some comparisons are drawn between electric arc and oxy-acteylene welding. In commenting on this letter, in the May issue of the *Acetylene Journal*, Mr. S. W. Miller, of Rochester, hits the nail on the head. The letter to *Power* was as follows:

"On account of the rapidly advancing field of autogenous welding in construction, maintenance and salvage work, the following results as shown by practical working tests may be of interest. These tests were performed by F. Hutton, M. E., a well-known welding expert, and myself. They covered a period of about two years, and afforded ample opportunity for a careful investigation of the subject from various standpoints.

"The first class of work which I will here attempt to describe consisted of the repair by welding of defective B. & W. boiler steel headers, designed to withstand a working pressure of 225 pounds. The welding required to repair the headers consisted of the filling in of worn lower corners and building up thinned 4-inch tube seats to the original thickness with ample reinforcement to allow for machining. The saving effected by arc welding these headers amounted to from 90 to 96 per cent of the original cost of new headers.

"We obtained the best results with a direct-current, constant-potential machine with low voltage and a readily regulated heat control. A voltage not exceeding forty was used, and a metallic electrode giving a high tensile strength of weld and approximately 0.25 carbon and 0.7 manganese in the weld was found best for this class of work. After completing the welding and placing headers in the boring mill for machining the tube seats, it was found that the welded metal worked under the tool fully as well as the metal comprising the original header. In fact, any line of demarcation between weld and original metal was very hard indeed to locate by occular inspection.

"We found, when inspecting the interior of these headers after over a year of continuous use under unfavorable working conditions, that the welded and built-up sections had in no way deteriorated. Much to the contrary was our experience with headers of the same type, physical and chemical properties as those already mentioned, but which were welded by the oxy-acetylene process. After being welded by this process, and when the machining of the tube seats was started, large sections of the weld tore or fell off under the tool, and in some cases the entire body of welded metal fell off, showing that no actual weld union had taken place, but only a sort of surface fusion or cementation which was easily loosened by contraction stresses and tool impact.

"It is believed that in the first-mentioned case, where portions only came off, that the headers had received the re-

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Hold on! What were you doing just then? Storing away that interesting bit of welding experience, or a photograph, perhaps? Don't do it? Give it to us. We want to show it to 4,099 other readers of The Welding Engineer (you're the forty-one hundredth). If there are objectionable features to it, just leave it to the Editor (he studied surgery), cutting off and adding to is his hobby.

Another thing, when you work out a successful solution to a welding problem write us about it. Grammar and composition don't count—it's ideas we want. If a sketch would illustrate your job in good shape, just make a rough pencil sketch; our draughtsman will do the rest.

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quired preheating necessary to insure a weld, but that the ensuing contraction stress caused cracks to develop in the weld and surrounding metal.

"The second series of practical tests was in the salvage of pitted and broken ship propellers. The first repairs made in this class of work were by the oxy-acetylene process and consisted in filling in pitted portions of blades and welding on special cast blade tips. The propeller blades having such a large area compared with their thickness, it was found that when the necessary preheating was done the blade had warped a considerable distance out of its original form. This meant, when the welding was completed, that an annealing treatment was required to restore the blade to its original contour and relieve contraction stress. This annealing was found to be only a partial remedy as the blade was not entirely restored to its original form, and without doubt a state of constant internal stress remained in the blade, tending to produce fracture when the usual working load was applied. Subsequent events seemed to prove this theory.

"After the welded propellers were placed in service and subjected to the usual working stress, the blades broke off one at a time, and they all broke directly in the weld, the last blade on one propeller breaking off less than four months after the propeller was placed in service. This same class of work was performed on other like sets of propellers, but in this case the electric arc process was employed. The same type of welding machine, voltage and equipment were used for this work as for the headers previously described. A softer metal electrode of less tensile strength was used in order to make the subsequent grinding and surfacing more easily done. The welding heat being well localized and under close control, no noticeable deformation of blade was produced; hence no annealing process was required, and the blades appeared to be free from any injurious internal stress.

"After nearly twenty months' use, and being exposed to the same working conditions as mentioned in the case of the gas-welded propellers, an examination in dry dock was made. The welding and tips were found to be intact and in their original good condition except for a slight pitting, due no doubt to galvanic action. The saving effected by welding these propellers by the arc process amounted to from 70 to 78 per cent of their cost when new. On the other hand, in the case of the gas-welded propellers a considerable loss was incurred, due to the cost of dry docking, removal and replacing of propellers.

"The results obtained on the two classes of work cited were repeated with various modifications on many other classes of work, and with various metals, including cast iron, cast steel, mild steel, nickel steel, bronze, monel metal and other alloys. In all classes it was found that the electric-arc weld was superior to the gas weld both in quality of work and in cost. I believe this to be due principally to the closely localized character of the heat generated by the electric arc, thereby minimizing heat deformation and contraction stress in the member being welded.

"The distinct function of the oxy-acetylene flame is for cutting, and in that field it is, I think, unexcelled.

"I would invite a discussion on any lines pertaining to this subject.

"Charles T. Perry, Mechanical Engineer,
"Department of Plant and Structures,
"New York City."

Mr. Miller's letter to the *Acetylene Journal* follows:

"I presume you and many of your readers have noticed in *Power* of April 13th an article by Mr. Perry, in which he makes some statements which reflect on the possibilities of oxy-acetylene welding, and in which he states quite clearly that metallic electrode arc welding has given him better results in the welding of cast iron, etc., than oxy-acetylene welding.

"The first part of the article cites two cases, one of cast steel water tube boiler headers welded by the oxy-acetylene process, in which the added material was pulled off during the machining. The other was that of some propeller blades which had had the ends broken off, and which failed after short service, by breaking through the welds.

"So far there is nothing to criticize in the statement. Those of us who are familiar with gas welding recognize instantly that the operators who welded these pieces were incompetent, and simply plastered the metal on without proper fusion. But the result of the statement, to those not familiar with welding, and many readers of *Power* are not, is to create a distrust of oxy-acetylene welding, simply because it is oxy-acetylene welding. It is hardly credible that Mr. Perry would deliberately condemn this type of welding, if he were familiar with what has been successfully done by its use; the only conclusion then is, that he has never seen good work done by the oxy-acetylene method.

"Rochester is a small city, and yet in it I can locate at least seven oxy-acetylene welders who could do both of the jobs he refers to, and not think them out of the ordinary. And I have personal acquantance with at least fifteen more equally capable.

"In this day it is hardly indicative of a full knowledge of the possibilities of welding methods, to make such comparisons as Mr. Perry has done, and I feel that with fuller knowledge of the oxy-acetylene process, he will be willing to admit that his annoying experiences with it have been due to poor work, and not to the process itself.

"Those of us who are familiar also with arc welding, know that much bad work is done by that process and that many equally serious failures have occurred in pieces welded by it; in such cases a fair and competent judge would recognize the real cause—poor welders.

"With regard to the welding of other metals by the electric arc, it is a fact that the job shops using both methods nearly always use the oxy-acetylene for all metals except steel. We have, as have others, sometimes pinned or studded a break in cast iron and welded it electrically, but I know of no job shop that has to guarantee its work, that would take a chance on such a method, on a punch press frame, for instance, where the full strength of the section must be developed. Yet such work is done every day by oxy-acetylene welding in many shops, with full confidence and entire success.

"The welding of the other metals mentioned by Mr. Perry is a complicated subject, and cannot be dismissed by the broad statement that arc welding is better than oxy-acetylene. For a long time I have been trying to get some samples of these materials arc welded, but have been entirely unsuccessful. I hope that some one will send me such samples. I shall be glad to publish my findings.

"In conclusion, a question may be asked. We all know that there are incompetent and quack doctors. Do we condemn the practice of medicine because of this undoubted fact?

"S. W. Miller."

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The Page Stool & Wire Co. have just published a very complete pamphlet describing fully the electrical and physical properties of American Ingot Iron Wire. This is the first complete publication of this data and the result of many tests made during the past two years under the supervision of the Electrical Testing Laboratory, New York, and Franko F. Fowle, consulting engineer for this company.

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APPOINTMENT OF MR. CHARLES F. LEDERER

Charles F. Lederer, until recently superintendent of Way of the Milwaukee Electric Railway & Light Co., Milwaukee, Wis., has become associated with the Rail Welding Department of the Metal & Thermit Corporation, New York.

Mr. Lederer is particularly well equipped for his new duties by reason of his active and successful experience with thermit welding in the Way Department of the Milwaukee Company. He entered the track department of the Milwaukee Electric Railway & Light Co.. in April, 1908, and was soon promoted to construction gang foreman. In 1904 he was appointed division roadmaster and in 1912 became city roadmaster. In May, 1919, he rose to assistant superintendent, and in September, 1919, became superintendent of way, which position he held until his recent resignation from that company.

In the above mentioned capacities, Mr. Lederer obtained much practical experience in thermit insert rail welding and in the construction of thermit welded special work as well as in making repairs to broken frogs, switches and mates by this method without even removing them from their location in a special work layout. In fact, Mr. Lederer, so far as known, has the distinction of having made, in April, 1915, the first thermit welded frog. This frog has given excellent service.

D-B CHANGES

The Davis-Bournonville Company, Jersey City, New Jersey, manufacturers of oxy-acetylene and oxy-hydrogen welding and cutting apparatus, has acquired a new and larger factory location for its Canadian plant, which will be moved from Niagara Falls, Ontario, to Toronto, in June. The Toronto sales office will be moved from its present location on King Street West, to quarters in the new factory building at 32-34 Eastern Avenue. The location is adjacent to the immense harbor development now under way, convenient to rail and water terminals, and readily accessible to the business center. The company's Montreal sales office will be moved about June 1, from Craig Street West, to quarters in the Coristine Building, St. Paul and St. Nicholas Streets, Montreal, occupying offices on the second floor.

A WELDER'S UNION

Editor:

What is crystallization of iron or steel?

What action takes place on the crystallization of boiler plate?

What properties are destroyed?

What are the contents of the granulated metal after being crystallized?

What is the difference between crystallization and burnt iron?

Is oxidation and burning of iron and steel the same?

Now I wish to go on a little farther, I will try and make this short as possible and ask that it be subject to the editor's approval for a place in next month's issue and also the answers to the questions I ask or as the editor's observation as to what part should be published. The next is the subject of welders and welding.

Why cannot the welders have a union of their own?

How can the welders convince the trade unions that welding is a trade by itself?

Why not start a national boom for a welders' union?

I have worked for the past five years at welding. I claim to do more than any craft welder can, because I have worked on different kinds of welding and study it. A craft welder is merely a one-sided welder. I wish to say to the public that I am glad there is a trade journal like *The Welding Engineer*. That if all the welders subscribed to it, they would profit by it. I use it as a big part of my reference library. I wish some of the old timers would start something on the line of a welders' union. I will take an examination for a welder soon as any one can show me one that is legal; it would be a good thing to make all welders pass such examinations before being allowed to work at the trade.

Ralph Leonard.

Editor's Note—Space does not permit us to answer all of Mr. Leonard's questions, but we might say that a Welders Union has been organized at Newport News. Refer to The Welding Engineer for February, 1920.

THE BUREAU OF STANDARDS TEST

Editor:

Can any one explain through the columns of *The Welding Engineer* why the test of the oxy-acetylene welding and cutting blow pipes now going on at the Bureau of Standards in Washington should be so strongly opposed by two of the leading oxy-acetylene equipment manufacturers?

It seems that one of them objects so strongly that it has endeavored through the American Welding Society to have the test stopped. As a member of the society I have failed to ever hear of any such action being authorized by it.

This movement having failed, they have now undertaken, through a prominent representative from Illinois, to have it stopped through political channels. Good luck and more power to them if they are able to get away with it, but I can't quite see their contention. They apparently fear the test might be somewhat severe and subject the blow pipes to harder usage than they would get in actual practice, but why is not, "What is fair for one, fair for all?" Is it possible that they fear the results of a non-biased, accurate test of their equipment in competition with others? Maybe some one who knows the details, or the companies themselves, can give some explanation and thereby help the unitiated from getting into a bog, if there is one.

Philip Kearny, President,
K.-G. Welding & Cutting Co., Inc.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of *The Welding Engineer*, published monthly at Chicago, Ill., for April 1, 1920, State of Illinois, County of Cook, ss.

Before me a notary public in and for the State and county aforesaid, personally appeared L. B. Mackenzie, who, having been duly sworn according to law, deposes and says that he is the publisher of *The Welding Engineer*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, L. B. Mackenzie, Chicago, Ill.
Editor, L. B. Mackenzie, Chicago, Ill.
Managing Editor, L. B. Mackenzie, Chicago, Ill.
Business Manager, L. B. Mackenzie, Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
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L. B. Mackenzie, 7131 Crandon Ave., Chicago.
M. J. Hungerford, 6107 Dorchester Ave., Chicago.

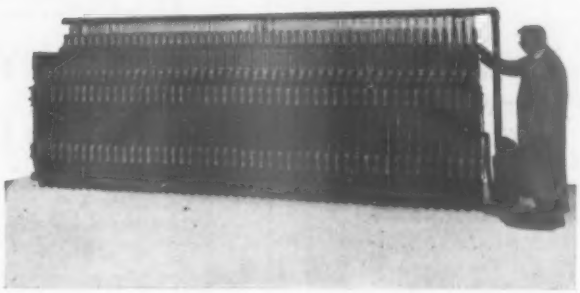
3. That the known bondholders, mortgages, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is—
(This information is required from daily publications only.)

L. B. Mackenzie.

Sworn to and subscribed before me this 23rd day of March, 1920.
[SEAL] Stella I. Lindquist.
(My commission expires, Nov. 7, 1923.)



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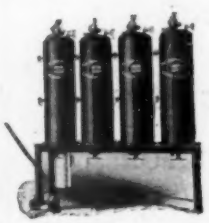

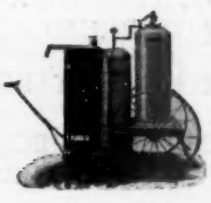

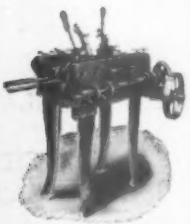

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